This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

George Ross

Westmore

Westlake

1817
ARTES
SCIENTIA
VERITAS
LIBRARY OF THE
UNIVERSITY OF MICHIGAN
TUEBOR
SI QUAERIS PENINSULAM AMOENAM
CIRCUMSPICE

George Ross Costerton

THE
ARITHMETICIAN'S ASSISTANT,

BEING

A COMPLETE SYSTEM

OF

PRACTICAL ARITHMETIC,

DESIGNED

AS A TEXT-BOOK,

FOR THE USE OF SCHOOLS, MEN OF BUSINESS, &c.

BY R. WISEMAN,

TEACHER OF ARITHMETIC, ETC. CUPAR IN FIFE.

ST ANDREWS:

PRINTED FOR THE AUTHOR,
BY J. MORISON, PRINTER TO THE UNIVERSITY;
AND SOLD BY R. MORISON & SON, PERTH; J. GUTHRIE,
J. ELDER, J. DICKSON, BELL & BRADFUTE, EDINBURGH; BRASH & REID, GLASGOW; R. BARR,
GREENOCK; J. IMLACH, BANFF; AND
W. CHARNLEY, NEWCASTLE.

1798.

QA
35
.W81

ENTERED AT STATIONERS' HALL.

Hist of Sci.
Seminar
2-19-35
30728

DEDICATION.

TO LIEUTENANT-GENERAL

SIR JAMES STEUART DENHAM,

OF COLTNESS AND WESTSHIEL, BARONET;

AND MEMBER OF PARLIAMENT FOR THE COUNTY OF LANERK.

SIR,

PERMIT me to preſent you with the following work, calculated to render the ſtudy of ARITHMETIC more methodical, eaſy, and entertaining to the learner;—not as a compliment, but as a mark of that profound veneration and reſpect which I have always entertained to the memory of your worthy father, and of that attachment and gratitude with which I have the honour to be,

SIR,

Your moſt obedient,

much obliged,

and very humble ſervant,

R. WISEMAN.

3-15-40

PREFACE.

IN a mercantile country, ſuch as Great Britain, where the exiſtence of many thouſands depends on trade, both ſkill and addreſs are requiſite in the induſtrious merchant, to enable him to carry into effect his ſchemes of commerce.

Youth, deſtined for the mercantile profeſſion, ought to be early initiated, and well founded, in the principles of *arithmetic*; for it is by a thorough knowledge of this ſcience alone that a juſt calculation is made, by which the merchant can judge with certainty when, and where, to embrace his opportunity of profit.

Books on *arithmetic* conciſely written and methodically arranged, are a treaſure to the young accountant: neither can too many attempts be made to improve and render them complete; and here I ſhall offer no other apology for the preſent publication.

In this new ſyſtem of *practical arithmetic*, great care has been taken to expreſs every thing in ſimple language, ſo as to be the more generally uſeful. Brevity and perſpicuity are attended to throughout the whole, and prolixity and obſcurity every where avoided; ſo that it is preſumed, more uſeful matter will be found in this performance, than in many others of twice its ſize and double its price.

In the *decimal* department, the moſt approved methods of working finites, repetends, and circulates, are introduced and illuſtrated in the cleareſt manner, as far as they are uſeful, with their various applications to the buſineſs of the banker, the merchant, and the mechanic.

In a word, it is hoped that the whole will be found ſo digeſted and arranged as to form a complete ſyſtem of *arithmetic*, thereby fully anſwering the purpoſe of a TEXT-BOOK, in the ſcience it treats of, and to be of great uſe both to the tutor and pupil.

R. W.

N. B. A letter, poſt paid, addreſſed to the Author, will procure the ſolution at large, of any QUESTION *in the following work.*

CONTENTS.

Page
NOTATION - - - - - - - - - - - - - 1
Characters explained - - - - - - - - - - - 2
Addition of Integers - - - - - - - - - - - ib.
Subtraction of Integers - - - - - - - - - 4
Multiplication of Integers - - - - - - - - - 6
Diviſion of Integers - - - - - - - - - - 10
Tables of Coin, &c. - - - - - - - - - - 14
Reduction by Multiplication - - - - - - - - 16
——— Diviſion - - - - - - - - - - - 17
——— Conjoint or Mixt - - - - - - - - - 18
——— of Vulgar Fractions - - - - - - - 20
Addition of Vulgar Fractions - - - - - - - 23
Subtraction of Vulgar Fractions - - - - - - 24
Multiplication of Vulgar Fractions - - - - - 25
Diviſion of Vulgar Fractions. - - - - - - - ib.
Compound Addition - - - - - - - - - - 26
——— Subtraction - - - - - - - - - - 28
——— Multiplication - - - - - - - - - 30
——— Diviſion - - - - - - - - - - - 35
Simple Proportion - - - - - - - - - - - 38
Compound Proportion - - - - - - - - - 42
Proportion of Vulgar Fractions - - - - - - 45
Rules of Practice - - - - - - - - - - - ib.
Bills of Parcels - - - - - - - - - - - 49
Forms, &c. - - - - - - - - - - - - - 51
Reduction of Decimals - - - - - - - - - 52
Addition of Decimals - - - - - - - - - - 56
Subtraction of Decimals - - - - - - - - - 58
Multiplication of Decimals - - - - - - - - 59
Diviſion of Decimals - - - - - - - - - - 61
Application of Decimals - - - - - - - - - 62
Partnerſhip - - - - - - - - - - - - - 63
Profit and Loſs - - - - - - - - - - - - 65
Barter - - - - - - - - - - - - - - - 67
Tare and Trett - - - - - - - - - - - - 68

Page
Factorage - - - - - - - - - - - - - - 70
Inſurance - - - - - - - - - - - - - - 71
Single Poſition - - - - - - - - - - - - 73
Double Poſition - - - - - - - - - - - - 74
Simple Intereſt - - - - - - - - - - - - 75
Compound Intereſt - - - - - - - - - - - 84
Equation of Payments - - - - - - - - - 85
Exchange of Money - - - - - - - - - - - 86
——— with London - - - - - - - - - - - 87
——— Ireland - - - - - - - - - - - ib.
——— America, &c. - - - - - - - - - 88
——— Holland - - - - - - - - - - - 89
——— Hamburg - - - - - - - - - - - 91
——— France - - - - - - - - - - - 93
——— Spain - - - - - - - - - - - 94
——— Portugal - - - - - - - - - - - 95
——— Ruſſia - - - - - - - - - - - 96
——— Eaſt Indies - - - - - - - - - - 97
Drawing and Remitting of Money - - - - - - 98
Arbitration of Exchange - - - - - - - - 99
Involution, or Raiſing of Powers - - - - - - 100
Evolution, or Extraction of Roots - - - - - ib.
Square Root - - - - - - - - - - - - - ib.
Cube Root - - - - - - - - - - - - - 103
Duodecimals - - - - - - - - - - - - - 105
Promiſcuous Queſtions - - - - - - - - - 107

ARITHMETIC.

ARITHMETIC is the art of numbering, or of computing by numbers. The whole of this ſcience depends on five fundamental rules, viz. Notation, Addition, Subtraction, Multiplication, and Diviſion; and by the proper application and judicious management of theſe, the moſt complicated proceſſes, curious calculations, and ſurpriſing ſolutions, may be effected.

NOTATION.

Notation teaches the method of writing down, and expreſſing in figures, any number that can be conceived or propoſed.

The characters by which any number may be expreſſed are theſe ten, viz. 1, one; 2, two; 3, three; 4, four; 5, five; 6, ſix; 7, ſeven; 8, eight; 9, nine; 0, cypher; whoſe ſeveral local values may be eaſily learned from the following table.

Ten Thouſands of Billions.	Thouſands of Billions.	Hundreds of Billions.	Tens of Billions.	Billions.	Hundred Thouſands of Millions.	Ten Thouſands of Millions.	Thouſands of Millions.	Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thouſands.	Tens of Thouſands.	Thouſands.	Hundreds.	Tens.	Units.
9	3	4	8	4	9	8	7	6	5	4	3	2	1	3	9	4

Note. The operation of reckoning or reading the value of any number expreſſed in figures, is called Numeration.

Prob. I.—To write down any number in figures.

Rule.—Put the ſignificant figures in the places propoſed, and fill up the vacancies with cyphers.

Ex. 1.—Write down in figures, ſix hundred and forty-four millions. Anſ. 644000000.

2. Write down ſeven hundred and fifty-nine million, three hundred and twenty-four thouſand, three hundred and thirty-ſix.

Prob. II.—To read any ſeries of figures.

Rule.—Begin at the left hand, and reckon towards the right; to the ſimple value of each figure affix its local value; conclude each period by expreſſing its title, and omit the cyphers every where.

Ex. 1.—Read 7734039. Anſ. Seven millions, ſeven hundred and thirty-four thouſand, and thirty-nine.

2. Read 800734734.

3. —— 9100007133.

CHARACTERS EXPLAINED.

$+$ Plus, more; the ſign of Addition.
$-$ Minus, leſs; the ſign of Subtraction.
$\times$ Multiplied by; the ſign of Multiplication.
$\div$ Divided by; the ſign of Diviſion.
$=$ Equal to; the ſign of Equality.
: : So is; the ſign of Proportion; as 3 : 6 : : 8 : 16.
$\sqrt{}$ Square root.
$\sqrt[3]{}$ Cube root.

ADDITION OF INTEGERS.

Rule.—Arrange the given numbers ſo, that units, tens, hundreds, &c. may form ſo many columns reſpectively: Then beginning at the column of units, find its ſum; and for each 10 that ſum contains, carry 1 to the next ſuperior place, and write the exceſs (if any) exactly under the column added: Proceed in like manner with every ſucceeding column to the laſt; under which write down the whole ſum.

EXAMPLES.

(1.)		(2.)		(3.)	
48	3	4172	5	9443347	7
54	0	1473	6	948473	8
45	0	2541	3	94741	7
72	0	7374	3	9734	5
17	8	1294	7	949	4
84	3	7174	1	94	4
79	7	3426	6	9	0
399	3	27454	4	10497347	8

Note. The judicious teacher is here underſtood to ſubjoin examples ſimilar to the above to his pupils at pleaſure, till they acquire a tolerable eaſe and accuracy in adding.

Proof. By ejecting the 9s, as in the preceding examples.

PRACTICAL QUESTIONS.

1. G borrowed of H at one time L 9; at another L 27; at a third L 940; at a fourth L 7409; and at a fifth L 88441; What ſum was borrowed in all?
Anſ. L 96826.

2. A farmer has 14 horſes, 19 cows, 36 yearlings, 25 calves, 300 ſheep, 11 goats, and 18 hogs; Required the number of his live ſtock? Anſ. 423.

3. A gentleman has in his library 18 vols. folio, 84 do. quarto, 149 do. octavo, and 231 do. duodecimo; How many has he in all? Anſ. 482.

4. Lent A L 7480; B L 947; C L 91; D L 8; E L 117; and F L 4731; What ſum was lent in all?
Anſ. L 13374.

5. The account of a certain ſchool was as under,

viz. in the Primer 13; Spelling-book 16; Æſop's Fables 11; Bible 25; Collection 22; at Arithmetic 17; Book-keeping 3; and at Navigation 1; How many were there in all? Anſ. 108.

6. Borrowed of A ſixty-three pounds; of B twenty-nine pounds; of C three hundred and forty-eight pounds; and of D one thouſand and four pounds; What ſum did I borrow in all? Anſ. L 1444.

7. The produce of a corn farm was as under, viz. wheat 156 bolls; barley 72; beans 108; peaſe 119; and oats 390; How many bolls of grain did the farm produce? Anſ. 845 bolls.

8. Suppoſe a man to have been born in the year 1752; In what year will he be 65 years of age? Anſ. 1817.

9. Molly's fortune is L 840; Peggy's L 948; Eliza's L 582; and Janie is to have as much as all the three; Required her fortune? Anſ. L 2370.

SUBTRACTION OF INTEGERS.

Rule.—Write the *ſubtrahend* under the *minuend*, units under units, tens under tens, &c. Then beginning at the place of units, if the *ſubtrahend* figure be leſs than the one correſponding to it in the *minuend*, write down the difference; if equal, write down a cypher; but if greater, increaſe the *minuend* figure by 10, and then write down the difference; and for the ſaid 10 borrowed as above, 1 muſt be added to the next *ſubtrahend* figure; with which proceed as above directed to the end, and the remainder will ſhew the difference of the two factors.

EXAMPLES.

(1.)			(2.)
Minuend	7948436		973437428
Subtrahend	3428314		344542364
Difference	4520122		628895064
Proof	7948436		973437428

PRACTICAL QUESTIONS.

1. What is the difference between theſe two numbers, 807000314 and 97347018? Anſ. 709653296.

2. Required the exceſs of 707341 above 411114? Anſ. 296227.

3. How much does 888888 want of 1000000? Anſ. 111112.

4. Suppoſe a church to have been built in the year 1617; How old is it in the year 1799? Anſ. 182 years.

5. The abbey of Holyroodhouſe was founded in the year 1128; How old is it in the year 1799? Anſ. 671 years.

6. A gentleman who is now 87 years of age, was 39 years when his eldeſt ſon was born? Required the age of his ſon? Anſ. 48 years.

7. Borrowed L 700, and paid L 659; borrowed L 500, and paid L 511; borrowed L 400, and paid L 288; borrowed L 299, and paid L 333; Required the laſt balance? Anſ. L 108.

8. A was born in the year 1752, B 7 years ſooner, and C is 5 years older than B; Required their ſeveral ages in 1799? Anſ. $\left\{\begin{array}{l}\text{A } 47\\ \text{B } 54\\ \text{C } 59\end{array}\right\}$ years.

9. The diameter of the ſun, according to the obſervations of aſtronomers, is found to meaſure 890000 miles; that of the earth only 7970; Required the difference? Anſ. 882030 miles.

10. A gentleman whoſe fortune is 3000 guineas, gives his eldeſt ſon B 909 guineas; his ſecond C 808; and his third D 787; What ſum does he retain to himſelf? Anſ. 469 guineas.

11. A gentleman bought an eſtate of 25800 acres; of which he has ſold 7014 to A; 990 to B; 845 to C; and has let out in tack to ſundry tenants 14424 acres; How many does he retain? Anſ. 2527 acres.

N. B. The firſt ſtep in this rule is, to get the following table imprinted on the memory.

2 {
2 = 4
3 = 6
4 = 8
5 = 10
6 = 12
7 = 14
8 = 16
9 = 18
10 = 20
11 = 22
12 = 24

3 {
3 = 9
4 = 12
5 = 15
6 = 18
7 = 21
8 = 24
9 = 27
10 = 30
11 = 33
12 = 36

4 {
4 = 16
5 = 20
6 = 24
7 = 28
8 = 32
9 = 36
10 = 40
11 = 44
12 = 48

5 {
5 = 25
6 = 30
7 = 35
8 = 40
9 = 45
10 = 50
11 = 55
12 = 60

6 {
6 = 36
7 = 42
8 = 48
9 = 54
10 = 60
11 = 66
12 = 72

7 {
7 = 49
8 = 56
9 = 63
10 = 70
11 = 77
12 = 84

8 {
8 = 64
9 = 72
10 = 80
11 = 88
12 = 96

9 {
9 = 81
10 = 90
11 = 99
12 = 108

10 {
10 = 100
11 = 110
12 = 120

11 {
11 = 121
12 = 132

12 × 12 = 144.

RULE I.—Place the *multiplier* under the *multiplicand*, units under units, tens under tens, &c. Then beginning at the place of units, multiply the whole *multiplicand* by each figure in the *multiplier* ſucceſſively, remembering to place the firſt figure of each *product* exactly under its reſpective *multiplier*. Laſtly, add the ſeveral products, and their ſum will be the anſwer.

Note. The number to be multiplied is called the *multiplicand*; that by which we multiply is called the *multiplier*; and the number ariſing from the multiplication is called the *product*.

EXAMPLES.

(1.) 347254 multiplicand.
2 multiplier.
694508 product.

(2.) 8477563
4
33910252

3. Mul. 472864 by 5=2364320
4. —— 743486 × 6=4460916
5. —— 372425 × 7=2606975
6. —— 454728 × 8=3637824
7. —— 444333 × 9=3998997
8. —— 174342 × 10=1743420
9. —— 243941 × 11=2683351
10. —— 347449 × 12=4169388 } Anſ.
11. —— 423256 × 37=
12. —— 145689 × 75=
13. —— 923414 × 447=
14. —— 332211 × 8426=

Rule II.—When either or both factors have cyphers on the right, multiply by the ſignicant figures only, and annex the cyphers to the product.

EXAMPLES.

(1.) 7423000
2400
29692
14846
17815200000

(2.) 71200000
6400000
2848
4272
455680000000000

Rule III.—When the multiplier is a compoſite number, and the component parts not exceeding 12, multiply continually by theſe component parts.

EXAMPLES.

1. Mul. 74343 by 14
2. — 84327 × 16
3. — 94354 × 18
4. — 147749 × 20
5. — 343427 × 21
6. — 841714 × 22
7. — 147434 × 24
8. — 211743 × 25
9. — 112233 × 27
10. — 333333 × 28
11. — 423721 × 30
12. — 177777 × 32
13. — 444444 × 33
14. — 555555 × 35
15. — 123456 × 36
16. Mul. 7438112 by 40
17. — 8723428 × 42
18. — 1111111 × 44
19. — 3452468 × 45
20. — 1748184 × 48
21. — 3141471 × 49
22. — 2214142 × 50
23. — 9412364 × 54
24. — 3414123 × 56
25. — 2241414 × 60
26. — 1423421 × 66
27. — 2542103 × 72
28. — 1123421 × 84
29. — 4130004 × 121
30. — 1443043 × 144

Proof. The exceſs of the 9's ejected from the product of the exceſs of the 9's of the two *factors*, will juſt equal the exceſs of the 9's in the *product*, if the work is right.

PRACTICAL QUESTIONS.

1. How many ſquare feet are contained in a floor that meaſures 37 feet by 24? Anſ. 888 feet.

2. How many ſtones, each a foot ſquare, will pave a court that meaſures 99 feet in length, and 49 in breadth? Anſ. 4851 feet.

3. From Cooper in Fife to St Andrews is 9 miles, and ſuppoſing the road to be 30 feet broad; How many ſquare yards does it contain? Anſ. 158400 ſq. yds.

4. How many ſtrokes does the hammer of a regular going clock ſtrike in 156 days? Anſ. 24336 ſtrokes.

5. How many balls will ſerve a fleet conſiſting of 12 ſhips of 96 guns, 11 do. of 90 guns, 10 do. of 84 guns, and 20 do. of 64 guns, to ſupply them with 144 round of ſhot? Anſ. 613728 balls.

6. How many yards are contained in 9 bales of cloth, each conſiſting of 4 parcels, each parcel of 8 pieces, and each piece of 74 yards? Anſ. 21312 yards.

7. A grocer bought 96 cheſts of tea, at L 19 per cheſt; What was the price of the whole? Anſ. L 1824.

8. What quantity of corn will 8 men threſh in 36 days, at the rate of 3 bolls a man per day? Anſ. 864 bolls.

9. A field contains 840 ſhocks of 14 ſheaves each; Required the number of ſheaves? Anſ. 11760.

10. What number, divided by 27, will make the quotient 1111? Anſ. 29997.

11. There is a floor that meaſures 50 feet by 34; Required the difference of its area, and that of 3 other floors, each ½ of the above dimenſion? Anſ. 425 ſq. feet.

12. If a kingdom contains 54 counties, each county 64 pariſhes, each pariſh 340 families, and each family on an average 17 perſons; Required the number of perſons in the whole kingdom? Anſ. 8225280.

13. How many letters are there in a book that conſiſts of 14 volumes, each volume of 472 pages, each page of 45 lines, and each line of 40 letters? Anſ. 11894400 letters.

14. A miller being aſked how many fowls he had anſwered, I have 9 cocks; and for each cock 25 hens; and for each hen 2 chickens: moreover, each hen has 12 birds; How many had he in all? Anſ. 3384.

15. How many ſeeds are produced from 1 plant that has 14 ſtalks, each ſtalk 19 pods, and each pod 6 ſeeds? Anſ. 1596 ſeeds.

16. If a field of wheat, 500 yards long, be divided into 420 drills, and each yard in length of the drill to contain 4 plants, each plant 15 ſtalks, and each ſtalk on an average 11 grains; How many grains does the whole field contain? Anſ. 138600000.

17. A certain general had under his command 36 colonels; for each colonel 16 captains; for each cap-

tain 2 lieutenants; and for each lieutenant 32 privates; How many privates had he? Anſ. 36864.

18. How many balls will ſerve 500 gun-boats, each carrying 4 guns, ſo as the whole fleet may have 99 round of ſhot? Anſ. 198000.

19. In an army of 30000 men, it was found that their pay on an average came to 2 guineas a week per man; What ſum muſt be iſſued monthly for their ſubſiſtence? Anſ. 240000 guineas.

20. What is that gentleman's yearly income, who has L 19 per week? Anſ. L 988.

DIVISION OF INTEGERS.

Rule I.—Place the *diviſor* on the left of the *dividend*, with a curved line betwixt them; find how often it is contained in the feweſt figures poſſible on the left of the *dividend*, and put the figure expreſſing the number of times in the *quotient*; multiply the *diviſor* by it; place the reſult under the figures aſſumed in the *dividend*, and ſubtract it from them; to the remainder annex the next *dividend* figure, and proceed as above directed till the whole *dividend* is exhauſted.

EXAMPLES.

```
(1.)  3)74275(24758⅓
        6
        —
        14      Mentally.
        12      3|74275
        ——       ————————
         22      24758⅓
         21
         ——
          17
          15
          ——
           25
           24
           ——
            1
```

2. Divide 984734 by 4
3. —— 774743 ÷ 5
4. —— 356474 ÷ 6
5. —— 434343 ÷ 7
6. —— 743475 ÷ 8
7. —— 999999 ÷ 9
8. —— 414342 ÷ 10
9. —— 334455 ÷ 11
10. —— 432414 ÷ 12

$534)942343743(1745962\tfrac{35}{534}$

534

4083

3738

2454

2136

3183

2670

5137

4806

3314

3204

1103

1068

35

Proof. The product of the divisor into the quotient, with the remainder added, will exactly equal the dividend; or by ejecting the 9's. See the Text-Book.

Diviſors.	Dividends.	Quotients.	Rem.
15007	7437428412737475472342 8	4955972	12323
84371	4237426742847743742584 37	5022373	41901
571216	4901842730083000427431 42	858141	403552
8874372	1474342567721012345678 90	16613	431473
91004354	3198765432142233445566 77	3514	87243258
12012345	1517564575642243224322 43	12633	4503179

Rule II.—When there are cyphers to the right of the diviſor, point them off, and an equal number of figures to the right of the dividend. Divide the remaining figures as formerly, and the quotient will be the anſwer. Laſtly, to the remainder annex the figures pointed off from the dividend, which will make up the total remainder.

EXAMPLES.

74|000)813473|184(10992
734
687
213
Rem. 65184

94|0000)99436|7432(1057
543
736
Rem. 787432

Rule III.—When there is a fraction in the diviſor, multiply the integral part by the denominator, and to the product add the numerator for a new diviſor; multiply the dividend by the ſame denominator for a new dividend, and the quotient will be the anſwer.

EXAMPLES.

(1.) $4\frac{1}{2}$)9729
2
9)19458
2162 Anſ.

(2.) $48\frac{3}{8}$)748423
8
387)5987384(15471
2117
1823
2758
Rem. 494

PRACTICAL QUESTIONS.

1. If 22 pieces of cloth contain in all 2046 yards; How many yards are there in each piece? Anſ. 93 yds.

2. A certain county contains 124440 acres of ground, and 41480 inhabitants; How many acres are there to each? Anſ. 3 acres.

3. A gentleman has an eſtate of 2736 acres, which he wiſhes to lay out in 19 farms of equal extent; How many acres will there be in each? Anſ. 144 acres.

4. If a corn mill grind 7850 bolls in a year; What quantity is that per day? Anſ. 26 bolls.

5. A legacy of L 9500 is to be divided equally among 19 perſons; What ſum will each draw? Anſ. L 500.

6. If a regular going clock ſtrike 95640 ſtrokes in a year; How many is that per day? Anſ. 156.

7. A gentleman diſtributed L 129 among a certain number of poor people, and each got L 3; Required the number? Anſ. 43.

8. What number multiplied by 4005, will produce exactly the number 40086045? Anſ. 10009.

9. If 286 bolls are threſhed from 1430 ſhocks of wheat; How many ſhocks is that per boll? Anſ. 5 ſhocks.

10. If a field of 32 acres produce in all 416 bolls of grain; How many bolls is that per acre? Anſ. 13 bolls.

11. Suppoſe the diſtance betwixt Dunbar and Campbeltown to be 150 miles: Now, if a traveller ſets off from Dunbar to Campbeltown at the rate of 25 miles per day, and back again to Dunbar at the rate of 15 miles per day; In what time will he finiſh his journey?

Anſ. in 16 days.

12. Suppoſe 3182656 pines to be planted in an oblong field, in 32 rows, and each plant to be 7 yards diſtant from another; Required the length and breadth of the plantation, allowing 3 feet for the breadth of the fence that ſurounds it? Anſ. $\left\{\begin{array}{r}\text{696200 length}\\ \text{218 breadth}\end{array}\right\}$ in yards.

13. Suppoſe a county to contain 223140 acres of land, and 74380 inhabitants; How many acres are there to each perſon? Anſ. 3 acres.

14. A captain, a mate, and 56 ſailors, capture a prize of L 40020, which, according to agreement, is to be ſhared equally among all the men on board; What ſum will each draw? Anſ. L 690.

15. If the inhabitants of a city conſume 350400 bolls of wheat in a year; How much is that per week, and per day? Anſ. $\left\{\begin{array}{l}\text{960 per day.}\\ 6738\tfrac{6}{13}\text{ per week.}\end{array}\right.$

STERLING MONEY.

4 Farthings = 1 Penny.
12 Pence = 1 Shilling.
20 Shillings = 1 Pound.

TROY WEIGHT.

24 Grains = 1 Penwt.
20 Penwt. = 1 Ounce.
12 Ounces = 1 Pound.

APOTHECARIES WEIGHT.

20 Grains = 1 Scruple.
3 Scruples = 1 Dram.
8 Drams = 1 Ounce.
12 Ounces = 1 Pound.

AVOIRDUPOISE WEIGHT.

16 Drams = 1 Ounce.
16 Ounces = 1 Pound.
28 Pounds = 1 Quarter.
4 Quarters = 1 Cwt.
20 Cwt. = 1 Ton.

DRY MEASURE.

4 Lippies = 1 Peck.
4 Pecks = 1 Firlot.
4 Firlots = 1 Boll.
16 Bolls = 1 Chalder.

SCOTS LAND MEASURE.

36 Ells = 1 Fall.
40 Falls = 1 Rood.
4 Roods = 1 Acre.

SCOTS LIQUID MEASURE.

4 Gills = 1 Mutchk.
2 Mutchks. = 1 Chopin.
2 Chopins = 1 Pint.
2 Pints = 1 Quart.
4 Quarts = 1 Gallon.
16 Gallons = 1 Hhd.

WINE MEASURE.

2 Pints = 1 Quart.
4 Quarts = 1 Gallon.
63 Gallons = 1 Hhd.
2 Hhds. = 1 Pipe or Butt.
2 Pipes = 1 Ton.

CLOTH MEASURE.

4 Nails = 1 Quarter.
4 Quarters = 1 Yard.
3 Quarters = 1 Ell Flem.
5 Quarters = 1 Ell Eng.

LONG MEASURE.

3 Barleycs. = 1 Inch.
12 Inches = 1 Foot.
3 Feet = 1 Yard.
5½ Yards = 1 Pole.
40 Poles = 1 Furlong.
8 Furlongs = 1 Mile.
3 Miles = 1 League.

PAPER AND PARCHMENT.

24 Sheets = 1 Quire.
20 Quires = 1 Ream.
10 Reams = 1 Bale.

YARN.

120 Threads = 1 Cut.
2 Cuts = 1 Heer.
6 Heers = 1 Hank.
4 Hanks = 1 Spindle.

DOZENS.

12 Units = 1 Dozen.
12 Dozen = 1 Groſs.
12 Groſs = 1 Great Groſs.

TIME.

60 Seconds = 1 Minute.
60 Minutes = 1 Hour.
24 Hours = 1 Day.
7 Days = 1 Week.
4 Weeks = 1 Month.
13 Months = 1 Year.

CATALOGUE OF MEMORANDUMS.

	L.	s.	d.		L.	s.	d.
Guinea - =	1	1	0	Frederic-d'or =	0	17	6
Crown - =	0	5	0	Gold Rupee =	1	15	0
Moidore - =	1	7	0	Dollar =	0	4	6
Jacobus - =	1	5	0	Ducat =	0	9	4
Carolus - =	1	3	0	Livre =	0	0	10
Mark - - =	0	13	4	Piſtole =	0	8	4
An Angel =	0	10	0	Piſtole of Ex. =	0	18	0
Guilder - =	0	1	10	Ruble =	0	4	6
Dry Guilder =	0	5	3	Sequin of Ven. =	0	9	$5\frac{3}{4}$
Louis-d'or =	1	0	0				

$35\frac{1}{4}$ Cubic Inches - - = 1 Pint of ale and beer.
282 Do. - - - - = 1 Gallon do.
231 Do. - - - - = 1 Gallon of wine.
$103\frac{2}{5}$ Do. - - - - - = 1 Scots Pint.
$2150\frac{2}{5}$ Do. - - - - = 1 Corn or malt Buſhel.
2203 Do. - - - - = 1 Wheat Firlot.
$28\frac{7}{8}$ Do. - - - - = 1 Pint of wine.
$21\frac{1}{4}$ Scots Pints - - - = 1 Wheat Firlot.
2240 lib. Avoirdupoiſe = 1 Ton.
10 Quarters, or 80 Buſhels, = 1 Laſt of corn.
8 lib. Amſterdam weight = 1 Peck of meal.

240 lib. Avoirdupoiſe - = 1 Sack of flour.
4.0873 Wincheſter Buſhels = 1 Boll of wheat.
5.9626 Do. - - - - = 1 Boll of barley.
48 Cubic Feet of timber = 1 Ton.
40 Do. - - - - - = 1 Ton, carpenters meaſ.
1 Square mile contains 640 Engliſh Acres; or 537 Acres, 3 Roods, 4 Falls, and 16 Ells, Scots meaſure.
2 Pints and ½ Gill Scots, make 3 Engliſh Ale Quarts.

REDUCTION BY MULTIPLICATION.

Rule.—Multiply the given number continually by its equivalent in the next inferior denomination, adding in courſe the number thereto belonging (if any), and the laſt product will be the anſwer.

EXAMPLES.

1. Red. L 74 13 4¼ to farthings.
20
1493 ſhillings.
12
17920 pence.
4
71681 farthings.

2. Red. L 412 17 to pence and farthings.
Anſ. 99084d. 396336 f.
3. —— 84 lib. 9 oz. Troy, to grains. Anſ. 488160.
4. —— 9 ton, 12 cwt. to pounds. - - Anſ. 21504.
5. —— 112 chald. 9 bolls, to lippies. Anſ. 115264.
6. —— 409 acres, 3 roods, to ells. Anſ. 2360160.
7. —— 333 yards, 3 nails, to nails. - Anſ. 5331.
8. —— 412 years, 7 min. to ſec. Anſ. 12957235620.
9. —— 777 guin. 7 pence, to farth. Anſ. 783244.
10. —— 443 crowns, 2 ſhil. to pence. Anſ. 26604.
11. —— 111 pipes, 9 gal. wine, to pints. Anſ. 111960.

12. Red. 471 ells, 1 qr. Flem. to nails. Anſ. 5656.
13. —— 999 ells Engliſh to nails. Anſ. 19980.
14. —— 404 cwt. 3 qrs. to pounds. Anſ. 45332.
15. —— 154 lib. 9 oz. Apoth. to ſcrup. Anſ. 44352.
16. —— 49 years, 3 weeks, to ſec. Anſ. 1542844800.
17. —— 557 miles, 20 poles, to barleycorns.
Anſ. 105886440.
18. —— 12 ream, 10 quires, to ſheets. Anſ. 6000.

REDUCTION BY DIVISION.

Rule.—Divide the given number continually by its equivalent in the next inferior denomination, and the laſt quotient will be the anſwer.

EXAMPLES.

1. Red. 71681 farthings to pence, ſhil. and pounds.

4|71681
12|17920¼
2|0|1493 4
Anſ. L 74 13 4¼

2. Red. 7798 farth. to cr. &c. Anſ. 32 cr. 2s. 5½d.
3. —— 484360 grs. to pounds Apoth.
Anſ. 84 lib. 1 oz. 2 ſcr.
4. —— 34776 grs. to pounds Troy. Anſ. 6 lib. 9 dwt.
5. —— 8070592 drams to tons, &c.
Anſ. 14 ton, 1 cwt. 1 qr. 25 lib. 12 oz.
6. —— 347596 lip. to chald. Anſ. 339 ch. 7 b. 3 p.
7. —— 80028 ſq. ells to ac. &c. Anſ. 13 ac. 3 r. 23 f.
8. —— 88888 farth. to guin. Anſ. 88 guin. 3s. 10d.
9. —— 90972 lib. to tons, &c. Anſ. 40 t. 12 cwt. 1 qr.
10. —— 12957235620 ſec. to yrs. Anſ. 412 yrs. 7 min.
11. —— 783244 farth. to guin. Anſ. 777 guin. 7d.
12. —— 26604 pence to crowns. Anſ. 443 cr. 2s.

13. Red. 111960 pts. wine to tons. Anſ. 111 pipes, 9 gal.
14. —— 5656 nails to ells Flem. Anſ. 471 ells, 1 qr.
15. —— 19980 nails to ells Engliſh. Anſ. 999 ells.
16. —— 45332 lib. to cwts. &c. Anſ. 404 cwt. 3 qrs.
17. —— 1542844800 ſec. to yrs. &c. Anſ. 49 yrs. 3 w.
18. —— 105886440 b. c. to miles. Anſ. 557 m. 20 p.
19. —— 6000 ſheets to reams. Anſ. 10 ream, 10 quires.
20. —— 21504 lib. to tons, &c. Anſ. 9 ton. 12 cwt.
21. —— 74347 cuts to hanks and ſpindles.
Anſ. 1548 ſp. 3 h. 3 h. 1 cut.

CONJOINT OR MIXT REDUCTION.

When a number of any propoſed denomination cannot be reduced to the name required by multiplication or diviſion alone, both rules muſt be uſed promiſcuouſly; and this we call conjoint or mixt reduction.

Rule.—Reduce the given number to ſuch a denomination by the one, as may by the other be brought to the denomination required.

EXAMPLES.

1. Red. 544 dollars, at 4s. 9d. each, to pounds ſterl.

```
       544
        57 pence in a dollar.
      ----
      3808
     2720
    ------
  12|31008 pence in the given number of dol.
   2|0|2584 ſhil. in do.
    L 129 4
```

2. Red. 784 moidores, at 27s. to pounds ſterl.
Anſ. L 1009 16.
3. —— L 1009 16 to moi. at 27s. Anſ. 784 moi.
4. —— 408 moi. at 26s. 6s. to guin. Anſ. 514 g. 16s.

5. Red. 733 crowns to pounds. - Anſ. L 183 5.

6. —— 1481 qr. guin. to moi. at 26s. 6d. Anſ. $293\frac{41}{108}$ m.

7. —— 8440 bitts of Jamaica, at 4d. to crowns. Anſ. 562 cr. 3s. 4d.

8. How often will a wheel of 18 feet circumference turn round its axis in running betwixt Cooper and Kinghorn, the diſtance being 22 miles? Anſ. $6453\frac{1}{3}$ times.

9. Required the number of turnings that a wheel of 22 feet circumference will make in running 100 miles? Anſ. 24000.

10. A traveller had 32 purſes; in each of which was a moidore, a guinea, a crown, a dollar, and a gold rupee; How many pounds ſterling had he? Anſ. L 148.

11. How many Britiſh ſtatute miles are equal to 750 geographical ones, $69\frac{1}{2}$ of the former being equal to 60 of the latter? Anſ. 868 miles, 6 fur.

12. A gentleman diſtributed L 129 among a certain number of poor people, and each got 3s.; Required the number? Anſ. 860 people.

13. Bought 47 ſheep at 19s. each; What did the price of the whole amount to? Anſ. L 44 13.

VULGAR FRACTIONS.

Def. I.—A fraction is a part of an unit, ariſing from diviſion, and ſuppoſes the unit to be divided into ſome certain number of equal parts. It is expreſſed by two terms; the one wrote above a line, called the *numerator*, the other under the ſame line, called the *denominator*, and both together conſtitute the fraction; as $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{9}{13}$, &c.

II.—*A proper fraction* is, when the numerator is leſs than the denominator; as $\frac{3}{4}$, $\frac{5}{9}$, &c.

III.—*An improper fraction* is, when the numerator is equal to, or greater than the denominator; as $\frac{6}{6}$, $\frac{8}{7}$, $\frac{12}{5}$, &c.

IV.—*A compound fraction* is the fraction of a fraction, and is always expreſſed by the word *of*; as $\frac{3}{4}$ of $\frac{5}{7}$ of $\frac{8}{11}$, &c.

V.—*A mixt number* is compoſed of an integer and a fraction; as $8\frac{1}{2}$, $9\frac{3}{4}$, $127\frac{3}{8}$, &c.

PROB. I.—To reduce a whole number to a fraction of an aſſigned denominator.

RULE I.—Multiply the whole number into the aſſigned denominator for a numerator, and draw a line under it.

II.—Place the aſſigned denominator under the line, to complete the fraction.

EXAMPLES.

1. Red. 5 to a fraction whoſe denominator ſhall be 7.
$7 \times 5 = \frac{35}{7}$ Anſ.
2. —— 6 to a fraction whoſe denominator ſhall be 8.
$8 \times 6 = \frac{48}{8}$ Anſ.
3. —— 19 to a fraction whoſe denominator ſhall be 21.

PROB. II.—To reduce improper fractions to equivalent whole or mixt numbers.

RULE I.—Divide the numerator by the denominator, the quotient will be the integral part; and when there is no remainder, will be the anſwer.

II.—When there is a remainder, place it on the right of the integral part, with the diviſor under it, and a line betwixt them, and both together will conſtitute the mixt number.

EXAMPLES.

1. Red. $\frac{108}{9}$ to a whole or mixt number.
$108 \div 9 = 12$ Anſ.
2. —— $\frac{121}{3}$ to a whole or mixt number. $40\frac{1}{3}$ Anſ.
3. —— $\frac{172}{5}$ to a whole or mixt number. $34\frac{2}{5}$ Anſ.

PROB. III.—To reduce a mixt number to an improper fraction.

RULE I.—Multiply the integral part by the denominator, and to the product add the numerator for a new numerator.

II.—Under this new numerator place the old denominator, with a line betwixt them, to complete the fraction.

EXAMPLES.

1. Red. $5\frac{3}{4}$ to an improper fraɑ. $5 \times 4 + 3 = \frac{23}{4}$ Anſ.
2. —— $71\frac{3}{5}$ to an improper fraɑ. - - $\frac{358}{5}$ Anſ.
3. —— $12\frac{1}{7}$ to an improper fraɑ. - - $\frac{85}{7}$ Anſ.

Prob. IV.—To reduce a compound fraction to a ſimple one.

Rule I.—Multiply the numerators continually for a numerator.

II.—Multiply the denominators continually for a denominator.

EXAMPLES.

1. Red. $\frac{4}{5}$ of $\frac{8}{9}$ to a ſimple fraɑ. - $\frac{4}{5} \times \frac{8}{9} = \frac{32}{45}$ Anſ.
2. —— $\frac{4}{7}$ of $\frac{8}{11}$ of $\frac{3}{5}$ to a ſimple fraɑ. - Anſ. $\frac{96}{385}$.
3. —— $\frac{3}{5}$ of $\frac{4}{5}$ of $\frac{3}{7}$ to a ſimple fraɑ. - Anſ. $\frac{36}{175}$.
4. —— $\frac{4}{7}$ of $\frac{8}{9}$ of 12 to a ſimple fraɑ. - Anſ. $\frac{384}{63}$.

Prob. V.—To reduce a fraction to its loweſt terms.

Rule I.—Find a common meaſure by dividing the denominator by the numerator and the diviſor by the remainder continually, till nothing remain, and the laſt diviſor will be the common meaſure.

II. Divide both numerator and denominator by the common meaſure, and the two quotients will be the members of the new fraction in its loweſt terms.

EXAMPLES.

1. Red. $\frac{132}{348}$ to its loweſt terms.

```
132)348(2
    264            Then 12)132/348(11/29 the Anſ.
    ---
     84)132(1
         84
         --
         48)84(1
            48
            --
            36)48(1
               36
               --
               12)36(3
                  36
```

2. Red. $\frac{2548}{2912}$ to its loweſt terms. - - - Anſ. $\frac{7}{8}$.
3. —— $\frac{480}{940}$ to its loweſt terms. - - - - Anſ. $\frac{24}{47}$.

Prob. VI.—To reduce a fraction of one denomination to another.

If from a lower to a higher;—Rule.—Multiply the denominator by as many of the lower as make one of higher: If from a higher to a lower;—Rule.—Multiply the numerator by the above-mentioned number or numbers.

EXAMPLES.

1. Red. $\frac{4}{7}$ of a farthing to the fraction of a pound.
$\frac{4}{7} \times \frac{1}{4} \times \frac{1}{12} \times \frac{1}{20} = \frac{4}{6720}$ Anſ.
2. —— $\frac{3}{5}$ of a farth. to the fract. of a L. Anſ. $\frac{3}{4800}$.
3. —— $\frac{7}{9}$ of a lippie to the fract. of a chald. Anſ. $\frac{7}{9216}$.
4. —— $\frac{4}{7}$ L to the fract of a penny. $4 \times 20 \times 12 = \frac{960}{7}$.
5. —— $\frac{4}{5}$ lib. Troy to the fract. of a grain. Anſ. $\frac{23040}{5}$.
6. —— $\frac{8}{9}$ of a yard to the fract. of a nail. Anſ. $\frac{128}{9}$.
7. —— $\frac{5}{12}$ of a pound to the fraction of a guinea.
Operation. $\frac{5}{12} \times \frac{20}{21} = \frac{100}{252}$ Anſ.
8. —— $\frac{4}{7}$ of a crown to the fraction of a pound.
Operation. $\frac{4}{7} \times \frac{5}{20} = \frac{20}{140}$ Anſ.
9. —— $\frac{3}{8}$ of a moidore to the fract. of a pound. Anſ. $\frac{81}{160}$.
10. —— $\frac{7}{8}$ of a guin. to the fract. of a crown. Anſ. $\frac{147}{40}$.
11. —— $\frac{1}{4}$ Jacobus to the fract. of a pound. Anſ. $\frac{25}{80} = \frac{5}{16}$.
12. —— $\frac{1}{3}$ of a noble to the fract. of do. Anſ. $\frac{240}{1200} = \frac{1}{5}$.
13. —— $\frac{4}{7}$ of a piſtole of Ex. to the fract. of a guinea.
Anſ. $\frac{24}{49}$.

Prob. VII.—To reduce fractions of different denominators to others of the ſame value, having one common denominator.

Rule I.—Multiply each numerator into the denominators continually (its own excepted) for a numerator.

II.—Multiply the denominators continually, and the product will be the common denominator.

EXAMPLES.

1. Red. $\frac{3}{4}$, $\frac{4}{5}$, and $\frac{5}{6}$ to fractions of the ſame value, having one common denominator.

$$\left.\begin{array}{l} 3\times5\times6=\ 90 \\ 4\times4\times6=\ 96 \\ \underline{5\times4\times5=100} \end{array}\right\}\text{numerators}\quad\text{makes}\left\{\begin{array}{l} \frac{90}{120}=\frac{3}{4}. \\ \frac{96}{120}=\frac{4}{5}. \\ \frac{100}{120}=\frac{5}{6}. \end{array}\right.$$

$$4\times5\times6=120 \text{ common denom.}$$

2. —— $\frac{3}{7}$, $\frac{8}{9}$, $\frac{4}{5}$ to a com. denom. Anſ. $\frac{135}{315}$, $\frac{280}{315}$, $\frac{252}{315}$.

3. —— $\frac{4}{11}$, $\frac{8}{13}$, $\frac{9}{10}$ to a com. den. Anſ. $\frac{520}{1430}$, $\frac{880}{1430}$, $\frac{1287}{1430}$.

Prob. VIII.—To find the value of a fraction.

Rule.—Multiply the numerator into the inferior denominations one after another, beginning at the higheſt, and divide the ſeveral products by the denominator and the quotient will be the value required.

EXAMPLES.

1. Req. the value of $\frac{31}{40}$ of a pound ſterling?

$$\frac{31\times20\times12}{40}=15\text{s. 6d. Anſ.}$$

2. —————— of $\frac{4}{25}$ of a pound? Anſ. 3s. 2$\frac{1}{4}$d. $\frac{3}{5}$.
3. —————— of $\frac{7}{8}$ of a guinea? Anſ. 18s. 4$\frac{1}{2}$d.
4. —————— of $\frac{8}{11}$ of a chalder? Anſ. 11 b. 2 f. 2$\frac{2}{11}$p.
5. —————— of $\frac{9}{16}$ of a lib. Troy? Anſ.

ADDITION OF VULGAR FRACTIONS.

Prepar. I.—Reduce mixed numbers to improper fract.

II.—Reduce compound fractions to ſimple ones.

III.—Reduce fractions of different denominations to others of the ſame integer.

IV.—Red. fractions of different denominators to others of the ſame value, having one common denominator.

Rule.—Add all the numerators into one ſum; under which write the common denominator for the anſwer.

1. Add $\frac{5}{7}$, $\frac{6}{7}$, $\frac{4}{7}$. *Operation.* $5+6+4=\frac{15}{7}=2\frac{1}{7}$ Anſ.

2. —— $\frac{3}{4}$ of a pound, $\frac{2}{3}$ of a ſhilling, and $\frac{3}{4}$ of a penny.

$$\frac{2}{3}\times\frac{1}{20}=\frac{2}{60}\text{ L.}$$
$$\frac{3}{4}\times\frac{1}{12}\times\frac{1}{20}=\frac{3}{960}\text{ L.}$$

Then
$$\begin{array}{r} 3\times60\times960=172800 \\ 2\times\ 4\times960=\ \ \ 7680 \\ \underline{3\times\ 4\times\ 60=\ \ \ \ \ 720} \end{array}$$

$$\frac{181200}{4\times60\times960=230400}=15\text{s. }8\tfrac{3}{4}\text{d. Anſ.}$$

3. Add $9\frac{1}{4}$ to $12\frac{4}{5}$. - - - - - - - Anſ. $22\frac{1}{20}$.

4. —— $7\frac{3}{7}$ to $9\frac{1}{4}$ and $\frac{3}{4}$ of $\frac{8}{9}$. - - - Anſ. $17\frac{29}{84}$.

5. —— $\frac{4}{5}$ and $\frac{3}{4}$ of a L, and $\frac{3}{4}$ of a ſhil. Anſ. L 1 11 9.

6. —— $\frac{5}{6}$ of a guin. $\frac{1}{8}$ of a moi. and $\frac{2}{3}$ of a crown.
Anſ. L 1 4 $2\frac{1}{2}$.

7. —— $9\frac{1}{5}$ yds. $3\frac{1}{8}$ qrs. and $3\frac{1}{4}$ nails. Anſ. 10 yds. $2\frac{19}{20}$ n.

8. —— L $9\frac{1}{7}$, L $7\frac{1}{7}$, $3\frac{4}{5}$ guin. and $6\frac{4}{9}$ crowns.
Anſ. L 22 3 $5\frac{1}{4}\frac{67}{105}$.

9. —— $9\frac{1}{4}$ cwt. $8\frac{1}{2}$ do. $5\frac{3}{8}$ do. and $\frac{2}{3}$ of a qr.
Anſ. 23 cwt. 1 qr. $4\frac{2}{3}$ lib.

SUBTRACTION OF VULGAR FRACTIONS.

Rule.—Prepare the fractions as in addition; then will the difference of the numerators, ſet over the common denominator, be the anſwer required.

EXAMPLES.

1. What is the difference of $\frac{7}{12}$ and $\frac{11}{12}$?
Operation. $11-7=\frac{4}{12}$ Anſ.

2. ———————— of $\frac{3}{4}$ and $\frac{5}{8}$?

$$\begin{array}{r} 8\times3=24 \\ 4\times5=\underline{20} \\ 4 \\ 8\times4=32=\frac{1}{8}\text{ Anſ.} \end{array}$$

3. From $19\frac{2}{3}$ take $13\frac{6}{7}$. - - - - - Anſ. $5\frac{17}{21}$.

4. —— $9\frac{4}{5}$ take $4\frac{1}{7}$ and $\frac{3}{4}$ of $\frac{2}{11}$. - - Anſ. $5\frac{401}{770}$.

5. —— 21 take $\frac{4}{5}$ of $\frac{3}{4}$ of $\frac{8}{9}$. - - - Anſ. $20\frac{21}{45}$.

6. From $\frac{19}{20}$ take $\frac{7}{8}$ of $\frac{4}{7}$. - - - - - - Anſ. $\frac{9}{20}$.
7. —— $\frac{3}{4}$ of a pound take $\frac{3}{4}$ of a ſhil. Anſ. $\frac{57}{80}$ = 14s. 3d.
8. —— $17\frac{3}{5}$ chald. take $13\frac{3}{4}$ bolls. - - Anſ.
9. —— $\frac{8}{9}$ of a guin. take $\frac{3}{4}$ of a pound. Anſ. 3s. 8d.
10. What is the difference betwixt $\frac{7}{8}$ and $\frac{8}{9}$, and which of the two is the greateſt fraction? Anſ. $\frac{8}{9}$ and $\frac{1}{72}$ is dif.

MULTIPLICATION OF VULG. FRACTIONS.

Rule.—Prepare the fractions as in addition; then the product of the numerators ſet over the product of the denominators, will be the anſwer.

EXAMPLES.

1. Mult. $\frac{8}{11}$ by $\frac{5}{12}$. *Operation.* $\frac{8}{11} \times \frac{5}{12} = \frac{40}{132} = \frac{10}{33}$ Anſ.
2. Req. the continued prod. $\frac{1}{4}$, $\frac{4}{5}$, $\frac{5}{6}$, $\frac{6}{7}$? - Anſ. $\frac{1}{7}$.
3. ———————— $8\frac{1}{3}$, $1\frac{1}{6}$, and $\frac{5}{6}$ of $\frac{1}{2}$? Anſ. $4\frac{11}{216}$.
4. Mult. $8\frac{1}{5}$ by $3\frac{1}{4}$. - - - - - - Anſ. $26\frac{13}{20}$.
5. —— $48\frac{1}{4}$ by $7\frac{1}{3}$. - - - - - - Anſ. $353\frac{5}{6}$.
6. —— $14\frac{3}{7}$ by $\frac{1}{4}$ of $\frac{3}{4}$ of $\frac{3}{4}$. - - - Anſ. $2\frac{13}{448}$.
7. What is the price of $18\frac{1}{4}$ yds. of India muſlin, at 9s. $4\frac{3}{5}$d. per yard? - - - - Anſ. L 8 11 $2\frac{3}{4}$ $\frac{4}{5}$.
8. How many ſquare feet are there in a floor that is $21\frac{1}{3}$ feet long and $15\frac{1}{4}$ broad? - Anſ. $325\frac{1}{3}$ feet.

DIVISION OF VULGAR FRACTIONS.

Rule.—Prepare the fractions as in multiplication; then multiply the denominator of the diviſor into the numerator of the dividend for a numerator, and the numerator of the diviſor into the denominator of the dividend for a denominator to the quotient.

EXAMPLES.

1. Divide $\frac{4}{5}$ by $\frac{3}{4}$. *Operation.* $\frac{3}{4})\frac{4}{5}(\frac{16}{15} = 1\frac{1}{15}$ Anſ.
2. —— $\frac{11}{12}$ by $\frac{3}{5}$. - - - - - - - Anſ. $1\frac{19}{36}$.
3. —— $13\frac{1}{2}$ by $3\frac{1}{5}$. - - - - - - Anſ. $3\frac{29}{32}$.
4. —— $73\frac{1}{2}$ by $\frac{3}{5}$ of $\frac{7}{8}$. - - - - - Anſ. 140.

5. Divide $123\frac{1}{7}$ by $11\frac{1}{8}$. - - - - - Anſ. $11\frac{43}{623}$.
6. ——— $\frac{3}{4}$ of 7 by $\frac{2}{8}$ of 11. - - - - - Anſ. $1\frac{10}{11}$.
[illegible]What number multiplied by $9\frac{4}{5}$, will make the product $20\frac{1}{21}$? - - - - - - - - - Anſ. $2\frac{47}{1029}$.
8. Bought $142\frac{2}{5}$ yds. linen, at L $28\frac{4}{7}$; What did it coſt me per yard? - - - - - - - Anſ. $4\frac{8}{623}$s.
9. ——— $93\frac{3}{8}$ broad cloth, at L $64\frac{3}{5}$; What muſt I ſell it at per yard, to gain L $8\frac{4}{5}$ on the whole?
Anſ. 15s. $8\frac{1}{2}$d. $\frac{474}{747}$.

COMPOUND ADDITION.

RULE I.—Place denominations of the ſame kind under each other, and draw a line under them.

II.—Begin at the loweſt; and having found its ſum, carry by as many as make one of the next ſuperior, and write down the exceſs (if any) under the denomination added.

III.—Proceed in the ſame manner through all the denominations till the laſt, in which carry at 10 as in integers.

A MEMORANDUM TABLE.

FARTHINGS.		PENCE.		SHILLINGS.	
far.	d.	d.	s.	s.	L.
4 =	1	12 =	1	20 =	1
8 =	2	24 =	2	40 =	2
12 =	3	36 =	3	60 =	3
16 =	4	48 =	4	80 =	4
20 =	5	60 =	5	100 =	5
24 =	6	72 =	6	120 =	6
28 =	7	84 =	7	140 =	7
32 =	8	96 =	8	160 =	8
36 =	9	108 =	9	180 =	9
40 =	10	120 =	10	200 =	10
44 =	11	132 =	11	220 =	11
48 =	12	144 =	12	240 =	12

COMPOUND ADDITION.

EXAMPLES.

STERLING MONEY.

L.	s.	d.
443	15	4¼
344	17	5½
434	14	8¾
747	13	7½
845	12	9¼
442	15	4¾
233	13	0¼
3493	2	4¼

TROY WEIGHT

lib.	oz.	dwt.	gr
774	10	14	13
347	11	14	15
443	9	13	14
340	4	19	12
474	7	19	11
374	8	14	14
434	9	14	19

Note. The learner is here underſtood to work
examples under each of the tables of coin, weight
and then proceed to the following

PRACTICAL QUESTIONS.

1. Borrowed of A L 140; of B L 372 14 9;
L412 13 4½; of D L48 17 3¾; and of E L441 11
What ſum have I borrowed in all? Anſ. L 1417

2. A grocer has in caſh L 48 12 4; teas to the
of L142 17 3; ſugars L99 13 7½; fruits L111 1
confections L48 19 2¼; gin L27 12 4; rum L108
Req. the amount of his ſtock in trade? Anſ. L587 14

3. The appraiſation of a farmer's ſtocking and c
as under, viz. horſes L 96 15; cows L 65 9 6;
lings L 49 17 4; calves L 26 13 4; ſheep L 2
wheat L 182 10; barley L 97 4; oats L 150 1
potatoes L 14 7 6; peaſe L 6 6; What does the
amount to? - - - - - - - - - - - Anſ. L

4. A woollen-draper has on hand the following
tities of cloth, viz. blues 149 yds. 2 qrs. 3 nails; g
84 yds. 3 nails; various mixtures 241 yds. 1 qr. 2
ſcarlets 100 yds. 1 qr.; browns 123 yds. 2 qrs.; b
90 yds. 1 nail; flannels 217 yds. 2 qrs.; ſerges and
loons 82 yds. 2 qrs. 2 nails; How many yds. has he i
Anſ. 1089 yds. 3

5. Bought a horſe at L 22 15; a cow at L 9 1

a bull at L 8 8 9; a mare at L 17 17 6; an ox at L 13 10; an aſs at L 7 9 $9\frac{1}{2}$; a ram at L 1 3 $4\frac{1}{2}$; and a goat at L 2 1; What ſum paid the account? Anſ. L 82 17 11.

6. A father bequeathed his eſtate to his 3 ſons, Adam, Arthur, and Oliver, as follows, viz. Adam got L 4009 14 $6\frac{1}{4}$; Arthur L 2909 15 $9\frac{1}{2}$; and Oliver L 2000 9 $8\frac{1}{4}$; Req. the val. of the eſtate? Anſ. L 8920.

7. A vintner has in his cellar as under, viz. claret to the val. of L 200 15; ſherry L 140 10 6; port L 120 12 6; rum L 170 15 6; gin L 19 14 9; whiſky L 136 9 6; ſhrub and cyder L 18 1 6; and porter L 30 9; Req. the value of the whole? - - - - - Anſ. L 837 8 3.

8. A builder paid for ground L 172 15; the maſon's bill was L 444 4 4; the carpenter's L 511 5 6; the ſlater's L 104 9 $6\frac{1}{2}$; the ſmith's L 19 4 $2\frac{1}{4}$; the glazier's L 49 8 $4\frac{1}{2}$; What does the houſe coſt him when finiſhed?

Anſ. L 1301 6 $11\frac{1}{2}$.

9. Suppoſe a collector ſhould receive at Cooper-Fife L 2480 12 $7\frac{1}{4}$; at St Andrews L 2504 13 $4\frac{1}{2}$; at Craik L 840 15 9; at Anſtruther L 1004 17 $5\frac{3}{4}$; at Pittenweem L 990 12 $8\frac{1}{2}$; at Ely L 711 4 5; at Largo L 519 7; at Leven L 914 19; at Wemyſs L 399 7 6; at Dyſart L 1009 9 9; at Kirkaldy L 999 19 $9\frac{1}{2}$; at Kinghorn L 710 12 4; at Burntiſland L 1111 11 $11\frac{1}{4}$; at Inverkeithing L 2000 14; at Limekilns L 919 16 4; at Torryburn L 770 18 11; and at Dunfermline L 4111 12 $7\frac{1}{4}$; Req. the ſum of the collection?

Anſ. L 22001 5 6.

COMPOUND SUBTRACTION.

RULE I.—Place denominations of the ſame kind under each other, and draw a line below them.

II.—Begin at the right, and ſubtract the numbers in each denomination of the ſubtrahend from thoſe correſponding to them in the minuend, remembering to borrow in any denomination according to the number of times it is contained in the next ſuperior.

EXAMPLES.

STERLING MONEY.

	L.	s.	d.
From	884	12	5½
Take	587	14	7¼
Rem.	296	17	10¼
Proof	884	12	5½

TROY WEIGHT.

	lib.	oz.	dwt.	grs.
From	777	0	0	0
Take			1	14
Rem.	776	11	18	10
Proof	777	0	0	0

Note. As in addition, ſo likewiſe here, the ſtudent is directed to work a few examples under each table, and then proceed to the following queſtions.

1. Borrowed L 7004 13 4, and paid L 900 12 9¼; Req. the balance due? - - - Anſ. L 6104 0 6¾.

2. If a gentleman's yearly income amounts to L 43140, and his aſſeſſed taxes, &c. to L 2948 9 4½; What ſum does he nett annually? - - - Anſ. L 40191 10 7½.

3. Bought 4047 yds. broad cloth, and have ſold 2989 yds. 1 qr. 2 nails; What quantity remains?
Anſ. 1057 yds. 2 qrs. 2 nails.

4. A gentleman has an eſtate of 7045 acres; he has let in tack to ſundry tenants 6851 acres, 1 rood, 13 falls, 17 ells; What quantity does he retain in his own poſſeſſion? - - - - - - Anſ. 193 ac. 2 r. 26 f. 19 ells.

5. Lent John Trader L 400; Req. the balance due after having received from him goods to the amount of L 213 13 9½? - - - - - - - Anſ. L 186 6 2½.

6. A merchant took a leaſe of a ſhop for a certain time, for which he was to pay in all L 400 15. He paid at entry L 194 17 4½; ſome time after L 149 19 10½; and the balance is to be paid at the end of the leaſe; What does it amount to? - - - Anſ. L 55 17 9.

7. Suppoſe a merchant's whole debts amount to L 3011 16 4; his goods on hand to L 840 14 9½; bills L 598 12 7; accounts due to him L 407 7 7; Req. his total deficiency? - - - - - - Anſ. L 1165 1 4½.

8. Three thouſand acres of common are to be divided among 3 men, viz. A, B, and C; of which A is to have 790 acres, 1 rood, 18 ells; B 1040 acres, 3 roods, 14

falls, 27 ells; What quantity will fall to C's ſhare?
Anſ. 1168 ac. 3 r. 24 f. 27 ells.

9. G and X together bought 37 cwt. 1 qr. of ſugar, of which G took 21 cwt. 1 qr. 17 lib.; How much remained to X? - - - - - Anſ. 15 cwt. 3 qrs. 25 lib.

10. Subtract 3 lib. from 500 ton.
Anſ. 499 ton, 19 cwt. 3 qrs. 25 lib.

COMPOUND MULTIPLICATION.

RULE I.—Place the multiplier under the loweſt denomination of the multiplicand; by it multiply the ſeveral denominations therein, and carry according to the local value of each.

EXAMPLES.

1. What is the price of 4 pipes wine, at L 37 15 6¾ each?

L 37 15 6¾
4
Anſ. L 151 2 $3\frac{0}{4}$

2. Calculate 6 cwt. at L 3 17 6 per cwt. Anſ. L 23 5.
3. ——— 7 cwt. at L 4 1 9½. Anſ. L 28 12 6½.
4. ——— 8 acres, at L 36 9 6. - Anſ. L 291 16.
5. ——— 9 hhds. at L 5 9 3. - Anſ. L 49 3 3.
6. ——— 10 yds. at L 1 1 3. - Anſ. 10 12 6.
7. ——— 11 cwt. at L 7 7 7. - - - Anſ. 81 3 5.
8. ——— 12 acres, at L 42 3 7. - Anſ. L 506 6.
9. ——— 12 cwt. at L 7 7 7. - Anſ. L 88 11.
10. ——— 12 yds. at L 1 4 4. - Anſ. L 14 12.
11. ——— 12 hhds. at L 8 7 11. - Anſ. 100 15.
12. Mult. 8 cwt. 3 qrs. 12 lib. by 2.
Anſ. 17 cwt. 2 qrs. 24 lib.
13. ——— 7 ac. 3 r. 19 f. by 4. Anſ. 31 ac. 1 r. 36 f.
14. ——— 9 chald. 7 b. 3 firl. by 5. Anſ. 47 ch. 6 b. 3 f.
15. ——— 144 yds. 3 qrs. 2 nails by 8. Anſ. 1159 yds.
16. ——— 36 doz. 9 partic. by 9. Anſ. 330 doz. 9 part.

RULE II.—When the multiplier exceeds 12, and is the rectangle of any two or more numbers, neither of which exceed 12, multiply by theſe numbers or component parts ſucceſſively.

EXAMPLES.

1. What is the price of 96 yds. of linen, at 4s. 7½d. per yard?

$$\begin{array}{llll} & 4 & 7\frac{1}{2} & \\ & & 12 & \\ \hline \text{Thus.}\quad 2 & 15 & 6\frac{0}{4} & =12\text{ yds.} \\ & & 8 & \\ \hline \text{L } 22 & 4 & 0\frac{0}{4} & =96\text{ yds.} \end{array}$$

Or thus.

$$\begin{array}{llll} & 4 & 7\frac{1}{2} & \\ & & 4 & \\ \hline & 18 & 6\frac{0}{4} & =4\text{ yds.} \\ & & 4 & \\ \hline 3 & 14 & 0\frac{0}{4} & =16\text{ yds.} \\ & & 6 & \\ \hline \text{L } 22 & 4 & 0\frac{0}{4} & =96\text{ yds.} \end{array}$$

Or thus.

$$\begin{array}{llll} & 4 & 7\frac{1}{2} & \\ & & 8 & \\ \hline 1 & 17 & 0\frac{0}{4} & =8\text{ yds.} \\ & & 6 & \\ \hline 11 & 2 & 0\frac{0}{4} & =48\text{ yds.} \\ & & 2 & \\ \hline \text{L } 22 & 4 & 0\frac{0}{4} & =96\text{ yds.} \end{array}$$

2. Calculate 16 yds. at 4s. 9½d. - Anſ. L 3 16 8.
3. ——— 18 yds. at 4s. 8½d. - - Anſ. L 4 4 9.
4. ——— 21 yds. at 5s. 4¼d. - Anſ. L 5 12 5¼.
5. ——— 22 yds. at 4s. 10½d. - - Anſ. L 5 7 3.
6. ——— 24 yds. at 5s. 4¼d. - - Anſ. L 6 8 6.
7. ——— 28 yds. at 7s. 6¼d. - Anſ. L 10 10 7.
8. ——— 32 yds. at 3s. 9d. - - - Anſ. L 6.
9. ——— 33 yds. at 7s. 1½d. - Anſ. L 11 15 1½.
10. ——— 35 yds. at 1s. 11¼d. - Anſ. L 3 9 3¼.
11. ——— 36 yds. at 1s. 4d. - - Anſ. L 2 8.
12. ——— 42 yds. at 7s. 6½d. - Anſ. L 15 16 9.
13. ——— 45 yds. at 3s. 3d. - - Anſ. L 7 6 3.
14. ——— 48 yds. at 4s. 2½d. - - Anſ. L 10 2.
15. ——— 49 cwt. at L 2 7 1. - Anſ. L 115 7 1.
16. ——— 50 cwt. at L 4 3. - Anſ.
17. ——— 54 cwt. at L 2 4. - Anſ.
18. ——— 56 ſtone at 11s. 6d. - Anſ.
19. ——— 63 doz. at 9s. 6d. - Anſ.

20. Calculate 64 yds. at 4s. 4d. Anſ.
21. ——— 66 yds. at 3s. 7½d. - Anſ.
22. ——— 72 lib. at 9s. 1½d. - Anſ.
23. ——— 84 lib. at 3s. 9½d. - Anſ.
24. ——— 88 lib. at 10s. 3½d. - Anſ.
25. ——— 96 lib. at 5s. 5½d. - Anſ.
26. ——— 108 cwt. at L 1 12. - Anſ.
27. ——— 132 cwt. at L 3 4 6. Anſ.
28. ——— 144 cwt. at L 5 17 6. Anſ.

Rule III.—When component parts cannot be obtained for the whole multiplier, multiply by thoſe numbers whoſe product comes neareſt to it; then by that number which makes up the compliment, and the ſum of the products will be the anſwer.

EXAMPLES.

1. What is the price of 59 lib. of tea, at 5s. 3½d. per lib.?

$$
\begin{array}{rrr}
 & 4 & 3\frac{1}{2} \times 3 \\
 & & 7 \\
\hline
1 & 10 & 0\frac{1}{2} \\
 & & 8 \\
\hline
12 & 0 & 4\frac{0}{4} \\
 & 12 & 10\frac{1}{2} \\
\hline
L\ 12 & 13 & 2\frac{1}{2}
\end{array}
\begin{array}{l}
\\
\\
= 7 \\
\\
= 56 \\
= 3 \\
= 59
\end{array}
\left.\begin{array}{l}\\\\\\\\\\\\\end{array}\right\}\text{lib.}
$$

2. Calculate 29 lib. at 7s. 6d. - Anſ. L 10 17 6.
3. ——— 31 lib. at 3s. 3½d. - Anſ. L 5 2 0½.
4. ——— 39 lib. at 4s. 9d. - Anſ. L 9 14 3.
5. ——— 47 lib. at 5s. 3¾d. - Anſ. L 12 7 8¾.
6. ——— 59 lib. at 5s. 11½d. - Anſ. L 17 11 6½.
7. Mult. 69 yds. 3 qrs. by 71. Anſ. 4952 yds. 1 qr.
8. —— 4 cwt. 3 qrs. 12 lib. by 79.
Anſ. 383 cwt. 3 qrs. 24 lib.
9. —— 16 lib. 1 oz. 13 grs. by 98.
Anſ. 1576 lib. 4 oz. 13 dwt. 2 grs.

Rule IV.—When the multiplier is large, multiply continually by 10, till the value of 10, 100, 1000, &c. (according as the queſtion requires) be obtained; then the value of 1, 10, 100, &c. multiplied by the remaining part of the multiplier ſucceſſively in its due order, will give the value of each part. Laſtly, add the products, and their ſum will be the anſwer.

EXAMPLES.

1. What is the price of 2144 ſtones of hay, at $4\frac{1}{4}$d. per ſtone?

			$4\frac{1}{4}$ ×4	
			10	
		3	$11\frac{1}{2}$ ×4	
			10	
	1	19	$7\frac{0}{4}$ ×1	
			10	
	19	15	$10\frac{0}{4}$ =	1000
			2	
	39	11	$8\frac{0}{4}$ =	2000
		1	$7\frac{0}{4}$ =	4 ſtones.
		15	$10\frac{0}{4}$ =	40
	1	19	$7\frac{0}{4}$ =	100
Anſ.	L 42	8	$8\frac{0}{4}$ =	2144

2. Calculate the price of 3420 lib. tea, at 4s. 4d.
3. ———— 4807 yds. at 1s $4\frac{1}{2}$d.
4. ———— 9001 cwt. at L 1 2 4.
5. ———— 9999 bolls, at 14s. 6d.
6. ———— 99004 ſtones, at 4s. $4\frac{1}{4}$d.

PRACTICAL QUESTIONS.

1. What is the price of 7 ſtones of cheeſe, at $7\frac{1}{2}$d. per lib. Tron weight? - - - - - - Anſ. L 3 10.

2. What is the price of 33 ſcore of lambs, at L 7 7 7 per ſcore? - - - - - - - - - Anſ. L 243 10 3.

3. What length of a road will 2 men make in 42 days, when they can finiſh 3 poles, 2 yards, 2 feet, 4 inches a day? - - - - - - Anſ. 3 fur. 27 p. $\frac{1}{2}$ yd. 2 feet.

4. Required the weight of 508 ſpindles of yarn, each weighing 1 lib. 3 oz. 8 drs. Anſ. 5 cwt. 2 qrs. 3 lib. 2 oz.

5. Bought at the India-houſe 32 cheſts of tea, each weighing 3 qrs. 14 lib. at 4s. 3d. per lib.; What did the price of the whole amount to? - - Anſ. L 666 8.

6. If the ſtandard weight of 1 guinea of gold be 5 dwt. 9 grs., What will be the weight of 2000 guineas?
Anſ. 44 lib. 9 oz. 10 dwt.

7. A farmer ſold in one ſeaſon 150 bolls of wheat, at 23s.; 85 bolls of barley, at 18s.; 240 bolls of oats, at 12s.; and 1700 ſtones of hay, at 4½d. per ſtone; Req. the amount of his ſales? Anſ. 475 bolls. L 424 17 6.

8. 57 Britiſh ſailors having captured one of the Manilla ſhips, and the prize money being equally divided among them, each received L 2496 13 7¼; Req. the value of the prize? - - - - Anſ. L 142310 15 5¼.

9. Req. the weight of 13 cart loads of hay, each weighing 12 cwt. 3 qrs. 15 lib.? Anſ. 167 cwt. 1 qr. 26 lib.

10. A legacy being equally ſhared by 49 relations, each received L 132 14 3¾? Req. the amount of the legacy? - - - - - - - - Anſ. L 6502 19 3¼.

11. Bought 8 horſes at L 17 10 each; 9 cows at L 9 14 6; 5 oxen at L 10 12 6; 18 calves at L 2 15; 19 ewes at L 1 3; and 25 lambs at 14s. 9½d. each; For how much money may I draw on my banker to pay the account? - - - - - - - - - Anſ. L 348 12 9½.

12. What ſum will pay 342 day-labourers for 4 days, at 1s. 3½ per day? - - - - - - - Anſ. L 88 7.

13. A merchant bought 7 bales of cloth, each containing 4 parcels, each parcel 16 pieces, and each piece 75 yards, at 10¾d. per yard; Req. the number of yards, and price of the whole? Anſ. 33600 yds. L 1505.

14. A certain kingdom contains 30 counties, each county 63 pariſhes, each pariſh 460 families, and each family 7 perſons. Now, ſuppoſing a tax of 5s. 3d. per head to be impoſed, What would it amount to?
Anſ. L 159752 5.

15. What is the weight of 56 kitts of butter, each

weighing 2 ſtones, 11 lib. 8 oz.; likewiſe of the empty kitts, at 3 lib. 9 oz. each? Anſ. { Butter, 152 ſt. 4 lib.
Kitts, 12 ſt. 7 lib. 8 oz.

16. A nobleman diſtributed a certain ſum of money among 43 paupers; to each he gave 11s. 4½d.; Req. the ſum? - - - - - - - - Anſ. L 24 9 1½.

17. What is the price of 473 ſheep, at 19s. 3¼d. each? Anſ. L 456 14 9¼.

18. What ſum will defray the weekly expence of 13 maſons, at 2s. 1d. per day; 4 bricklayers, at 1s. 11½d.; 8 barrowmen, at 1s. 4d.; and 4 wrights, at 1s. 9d.? Anſ. L 16 11 6.

19. A gentleman's whole eſtate is laid out in 25 farms of equal extent, each of which contains 154 acres, 3 roods, and all of them are let in tack at L 1 2 6 per acre; Req. the amount of his rental? - Anſ. L 4352 6 10½.

20. What is the price of 17 pieces of linen, each containing 36 yds. at 4s. 6d. per yard? Anſ. L 137 14.

COMPOUND DIVISION.

Rule I.—Begin with the higheſt denomination, and work as directed in integers.

II.—Reduce the remainder to the next inferior denomination, and add thereto the given number of that name (if any). Divide this as before, and ſo on to the loweſt denomination.

EXAMPLES.

1. Divide L 7744 15 6 by 5.

5)7744 15 6(1548 19 1⅕.
27
24
44
4
20
)95
45
6
1

Mentally.

5|7744 15 6
1548 19 1⅕.

2. Divide L 8778 14 6 by 6. - Anſ. L 1463 2 5.
3. —— 4734 yds. 3 n. by 7. Anſ. 676 y. 1 q. 1 n.
4. —— 6482 ac. 3 r. by 8. Anſ. 810 ac. 1 r. 15 f.
5. —— 4225 ch. 12 b. by 9. Anſ. 469 ch. 8 b. 1 f. $3\frac{1}{9}$ p.
6. —— 7744 cwt. 3 qrs. by 10.
Anſ. 774 cwt. 1 qr. $25\frac{1}{5}$ lib.
7. —— 3772 m. 4 fur. by 11. Anſ. 342 m. 7 f. $25\frac{3}{11}$ p.
8. —— 4711 guin. by 12. Anſ. 392 guin. 12s. 3d.

Note. The following examples may be done mentally, by dividing ſucceſſively by the component parts of the diviſor.

1. Divide L 7190 19 by 14. - Anſ.
2. —— L 9999 9 9 by 16. - Anſ.
3. —— 7473 crowns by 18. - Anſ.
4. —— 4744 guineas by 21. - Anſ.
5. —— 3143 yards by 22. - Anſ.
6. —— 4144 miles by 24 - - Anſ.
7. —— 3007 lib. Troy by 25. Anſ.
8. —— 1300 lib. Apoth. by 27. Anſ.
9. —— 1903 cwt. 2 qrs. by 28. Anſ.
10. —— 974 guin. 7s. by 32. - Anſ.
11. —— 1347 dol. 2s. by 36. - Anſ.
12. —— 1447 cwt. 1 qr. by 42. Anſ.
13. —— 1547 hhds. 20 gal. by 49. Anſ.
14. —— 1647 bales, 12 ream by 56. Anſ.
15. —— 1747 years, 4 mo. by 64. Anſ.
16. —— 1847 yds. 3 qrs. by 96. Anſ.

PRACTICAL QUESTIONS.

1. At the expiry of a leaſe of 25 years, the proprietor found that he had received in full of rent L 3640 12 6; Req. the yearly rent of the tenement? Anſ. L 145 12 6.

2. A gentleman diſtributed L 20 15 among ſome poor people; Req. the number, when each got 5s.? Anſ. 83.

3. Suppoſe a perſon in 10 years to ſpend L 3480 12 6 of his own, and contract debts to the amount of L 1400; What is his expence per year, month, week, and day?

Anſ. { L 488 2 3 per year.
37 10 $11\frac{1}{4}\frac{3}{13}$ per month.
9 7 $8\frac{3}{4}\frac{4}{13}$ per week.
1 6 $9\frac{3}{4}\frac{4}{13}$ per day.

4. Bought 24 acres of land, at L 959 13; What did it coſt me per acre? - - - - - - Anſ. L 39 19 8½.

5. Thirteen gentlemen are equally concerned in an adventure to Sierra Leona, by which they loſe L 9004 18; Req. the particular loſs of each? Anſ. L 692 13 8¾.

6. An Eaſt-India merchant who has been 18 years in trade has realized a fortune of L 40780 17 6; How much is that per year on an average? Anſ. L 2265 12 1.

7. Bought 472 pieces of broad cloth, at L 5664 4 6; freight, carriage, &c. came to L 20 17 6; What muſt I ſell it at per piece to gain L 150 on the whole? Anſ. L 12 7 3.

8. The planet Venus revolves round the ſun in 224 days and 17 hours of our time; How many revolutions will ſhe perform in 21 years, 195 days, and 19 hours of the ſame time? - - - - - - - - - Anſ. 35 rev.

9. Divide L 4728 14 9½ among 4 men, A, B, C, and D. Give A ¼, B ⅕, C ⅙, and D the remainder.

Anſ. { L 1182 3 $8\frac{1}{4}\frac{3}{6}$ A.
945 14 11½ B.
788 2 $5\frac{1}{2}\frac{2}{6}$ C.
1812 13 $8\frac{0}{4}\frac{1}{6}$ D.

10. ——— L 1000 10 10 among 6 men, A, B, C, D, E, and F. Let A have the firſt ſhare, and each in ſucceſſion 2 guineas and 7d. more than the preceding one. Anſ. A receives L 161 8 8⅙.

11. ——— L 3009 9 9 among 8 men and 5 boys, in ſuch a manner that each man may have a ſhare, and each boy ⅔ of a ſhare.

Anſ. { L 319 3 $9\frac{0}{4}\frac{6}{11}$ each man.
91 3 $11\frac{0}{4}\frac{8}{11}$ each boy.

12. ——— L 108 15 6 among 4 men, 7 women, and 13 children, ſo that each woman may have double the ſhare of a child, and each man triple the ſhare of a woman.

Anſ. { L 2 2 $7\frac{1}{4}\frac{9}{17}$ child.
4 5 $3\frac{1}{4}\frac{1}{17}$ woman.
12 15 $11\frac{1}{2}\frac{3}{17}$ man.

D

13. If the clothing and education of 121 charity boys amount to L 1512 10 annually; What is the expence of each? - - - - - - - - - - - - - Anſ. L 12 10.

14. A father at his death left L 25000 to be divided among his 4 ſons, Jack, Tom, Bill, and Harry, as follows, viz. for each ſhilling Harry receives Bill is to receive 2, Tom 4, and Jack 7; What ſum does each receive?

$$\text{Anſ.}\left\{\begin{array}{rrll} \text{L } 1785 & 14 & 3\frac{1}{4}\,\frac{5}{7} & \text{Harry.} \\ 3571 & 8 & 6\frac{3}{4}\,\frac{3}{7} & \text{Bill.} \\ 7142 & 17 & 1\frac{1}{2}\,\frac{6}{7} & \text{Tom.} \\ 12500 & 0 & 0\frac{0}{4}\,\frac{0}{7} & \text{Jack.} \end{array}\right.$$

PROPORTION.

PROPORTION is that rule by which the value, number, or quantity of one kind of things is proportioned to the value, number, or quantity of another kind of things, according to ſome fixed ſtipulation or known concluſion.

SIMPLE PROPORTION.

Rule I.—To ſtate the Terms.

On the right hand ſet down that number which is of the ſame kind as the number required, which call the *term of compariſon*, and prefix four dots (thus : :); then take the two remaining terms, and having compared them with the term already ſet down, determine from the nature of the queſtion whether the anſwer ſhould be greater or leſs than the above mentioned term. If greater, ſet the greateſt of the two in the ſecond place, and the leaſt in the third place, with two dots between them (thus :); but if leſs, the contrary.

II.—To work the Queſtion, and find the Anſwer.

Diſtinguiſh the terms by denominating the one on the left hand the *antecedent*, and the other the *conſequent*; then the product of the *term of compariſon* and *conſequent* divided by the *antecedent*, will quote the fourth term or anſwer, and will always be of the ſame name with the term of compariſon.

EXAMPLES.

1. If 4 cwt. of flax coſt L 9; What will be the price of 32 cwt.?

a. c. L.
4 : 32 :: 9
9
|288
Anſ. L 72.

Or thus abridged.
a. c. L.
4 : 32 :: 9
1 : 8
9
Anſ. L 72

2. If 32 cwt. coſt L 72; What will 4 cwt. coſt?

a. c. L. L.
32 : 4 :: 72 : 9 Anſ.

3. If L 9 be the price of 4 cwt. of flax; What quantity, at the ſame rate, may I have for L 72?

a. c. cwt. cwt.
9 : 72 :: 4 : 32 Anſ.

4. If for L 72 I have 32 cwt. of flax; What quantity, at the ſame rate, will I have for L 9?

a. c. cwt. cwt.
72 : 9 :: 32 : 4 Anſ.

Proof. Vary the queſtion as in the four preceding examples, where each one proves another; or by multiplying the extremes and means, thus.

4 × 27 = 9 × 32 = 288.

Note. If any of the terms conſiſt of different denominations, reduce them to the loweſt; and let the *antecedent* and *conſequent* always be of the ſame name.

5. If 8 yds. 3 qrs. of linen coſt L 1 13; What will 48 yds. 2 qrs. coſt?

a. c. L. s.
Terms ſtated. $\overset{\frown}{8\ 3} : \overset{\frown}{48\ 2} :: 1\ 13$
4 4 20 L. s. d.
Terms reduced. 35 : 194 :: 33 : 9 2 $10\frac{3}{4}\ \frac{31}{35}$ Anſ.

6. If a ſtaff that is $3\frac{1}{2}$ feet long, when placed perpendicular on a horizontal plane, have a ſhadow of 5 feet; How high is that ſteeple whoſe ſhadow is 580 feet?

a. c. feet. feet.
5 : 580 : : $3\frac{1}{2}$: 406 Anſ.

7. Lent my friend on an emergency L 480 for 48 days; How long may I retain L 300 of his money to be indemnified? - - - - - - - - Anſ. $76\frac{4}{5}$ days.

8. A merchant bought a quantity of tea and ſugar; the quantity of tea was 48 lib. and for every 3 lib. of tea he had 8 lib. of ſugar; Req. the quantity of ſugar?
Anſ. 128 lib.

9. If a courier finiſh a journey in 27 days by travelling 8 hours per day; In how many days, at the ſame rate of travelling, will he finiſh the ſame journey when he travels 12 hours per day? - - - - Anſ. 18 days.

10. If an ounce of ſilver be worth 5s.; What is the value of a ſilver bowl that weighs 1 lib. 11 oz. 4 dwt.?
Anſ. L 5 16.

11. There is a ciſtern that holds 8000 ale gallons; it receives at one pipe 142 pints per hour, and diſcharges at another pipe 10 pints in the ſame time; In what time will it be filled?

a. c. h. d. h. m. ſec.
142—10=132 : 8000×8 : : 1 : 20 4 50 54 Anſ.

12. A, flying at the rate of 95 miles in 2 days, is purſued on the morning of the 4th day by B, poſting 115 miles in the ſame time; In how many days, and after how many miles travel, will A be overtaken?

115
95 c. days. days.
a. 20 : $142\frac{1}{2}$: : 2 : $14\frac{1}{4}$ travelled by B.
miles. fur.
Then $\frac{115}{2}=57\frac{1}{2}\times 14\frac{1}{4}=819$ 3 diſt. travelled by each.

13. A merchant bought 5 bales of Oſnaburgs, each containing 28 pieces, and each piece 75 yds. at the rate of 24s. for 18 yds.; What did the whole coſt him?
Anſ. L 700.

14. An architect computed that 8 men would build a wall in 40 days, but the proprietor would have it done in 10; How many men muſt he employ? - Anſ. 32.

15. If the penny loaf weigh 6 oz. when wheat is ſold at 24s. per boll; What ſhould it weigh when wheat is ſold at 18s.? - - - - - - - - - - Anſ. 8 oz.

16. If a garriſon of 2000 men have proviſions for 6 months; How many men will the ſame quantity ſerve 8 months? - - - - - - - - - - - - Anſ. 1500 men.

17. The whole valued rent of a pariſh is L.3003 3, and a rate of L.155 4 3 is granted to the poor; What ſum muſt A D pay whoſe valuation amounts to L400 10?
Anſ. L 20 15 $3\frac{3}{4}\frac{1645}{20011}$.

18. If the longeſt arm of the beam of a balance be 25 inches, and the ſhorteſt only 20; What weight ſuſpended on the ſhorteſt arm will equiponderate 24 lib. on the longeſt? - - - - - - - - - - - - - Anſ. 30 lib.

19. A traveller finiſhes a journey in 24 days by travelling 12 hours per day; In what time will he finiſh it when he travels 16 hours per day? - Anſ. 18 days.

20. How many yards $3\frac{1}{2}$ qrs. wide are equal in ſquare meaſure to 37 yds. $5\frac{1}{2}$ qrs. wide? - Anſ. $58\frac{1}{7}$ yds.

21. If a carrier receives 35s. for the carriage of 49 cwt. 30 miles; What weight may he carry 24 miles for the ſame money? - - - - - - - Anſ. 61 cwt. 1 qr.

22. If a carrier receives 35s. for the carriage of 49 cwt. 30 miles; What ought he to charge for the carriage of 61 cwt. 1 qr. the ſame diſtance? - - Anſ. L 2 3 9.

23. Bought 335 ells Engliſh, at L 300; What muſt I charge for 6 yds. of it to gain L 14 18 $8\frac{1}{2}$ on the whole?
Anſ. L 4 10 3.

24. If 231 cubic inches make a wine gallon, and 282 an ale gallon; How many gallons of ale will fill a caſk that holds 60 gallons of wine? - - Anſ. $49\frac{7}{47}$ gal.

25. If a pipe whoſe diameter is $9\frac{1}{2}$ inches empty a ciſtern in 12 hours; In what time will another do it whoſe diameter is 6 inches? - - Anſ. $30\frac{1}{12}$ hours.

26. If 32 yds. of linen are worth 6 yds. of broad cloth,

and 6 yds. of broad cloth worth 25 lib. of tea, and 25 lib. of tea worth 108 lib. of ſugar, and 6 lib. of ſugar worth 5s.; Req. the price of the 32 yds. linen? Anſ. L 4 10.

27. A farmer having ſold off his whole ſtocking, &c. finds that the value of his horſes amounts to L.340; his cows to L.284; his oxen to L210; his ſheep to L.199; wheat L 314; barley L 215; oats L 200; and peaſe, &c. L48: He is to lay the whole out on land which he has purchaſed at the rate of 2¼ acres for L 42 10; Req. the number of acres? - - Anſ. 95 ac. 3 r. 11$\frac{13}{17}$ f.

COMPOUND PROPORTION.

Rule.—Place the term of *compariſon* on the right, as in ſimple proportion, and diſpoſe of each pair of like terms according to the directions there laid down; then will there be two or more *antecedents*, and as many *conſequents*. Now the continued product of the term of compariſon and conſequents divided by the continued product of the antecedents, will quote the anſwer.

EXAMPLES.

1. If L 100 principal in 12 m[illegible]hs gain L 5 intereſt; What will be the intereſt of L [illegible] for 8 months?

	a.	c.	a.	c.	L.	
Stated.	12 :	8 ::	100 :	840 ::	5	Here L 5 int. is the term of compariſon.
Abridged.	3 :	2 ::	5 :	42		
	5			2		
	15			84.		
				5	L.	
				)420(	28 Anſ.	

2. If L 28 be the intereſt of L 840 for 8 months; What will be the intereſt of L 100 for 12 months?

a. c. a. c. L. L.
12 : 8 :: 840 : 100 :: 28 : 5 Anſ.

3. If 25 maſons build a wall 36 feet long, 6 high, and 2 thick, in 18 days 12 hours long; How many maſons muſt be employed to build another wall 144 feet long, 12 high, and 4 thick, in 10 days 15 hours long?

```
          a.   c.    a.   c.    a.  c.    a.  c.    a.   c.   maſ.
Stated.  15 : 12 :: 10 : 18 :: 2 : 4 :: 6 : 12 :: 36 : 144 :: 25
Abr.      5 :  4 ::  5 :  9 :: 1 : 2 :: 3 :  6 ::  1 :   4
                     5                                    4
                    25                                   16
                     3                                    9
                    75                                  144
                                                          2
                                                        288
                                                          6
                                                       1728
                                                         25
                                                       8640
                                                       3456 maſ.
                                                     )43200(576
```

Becauſe maſons is the number ſought; the given number of maſons (25) is the term of compariſon.

Note. The ſame anſwer may be obtained by taking the two ſolidities as one pair of terms, and their reſpective times as another pair, thus.

```
             a.    c.     a.     c.     maſ.
Stated.     150 : 216 :: 432 : 6913 :: 25
Abridged.    25 :  36 ::   1 :   16
                                 36
                                 96
                                48
                        Anſ. 576 maſons.
```

4. If 8 men dig 24 cubic yards of an earthen mound in 6 days; How many men muſt be employed to dig 36 cubic yards in 4 days? - - - - - - Anſ. 18 men.

5. If 18 men dig 36 cubic yds. in 4 days; How many cubic yds. will 8 men dig in 6 days at the ſame rate of working? - - - - - - - - - - Anſ. 24 cub. yds.

6. If the penny loaf weigh 8 oz. when wheat is ſold at 18s. per boll; What ought to be the weight of a loaf worth 8d. when wheat is ſold at 24s. per boll? Anſ. 48 oz.

7. If the 8d. loaf weigh 48 oz. when wheat is ſold at 24s. per boll; Req. the price of the wheat per boll when the penny loaf weighs 8 oz.? - - Anſ. 18s. per boll.

8. If 16 maſons build 32 roods in 3 days; How many roods will 18 maſons build in 15 days? Anſ. 180 roods.

9. If 18 maſons build 180 roods in 15 days; How many maſons will build 32 roods in 3 days? Anſ. 16 maſ.

10. If 4 men cut down 12 acres of graſs in 6 days; How many acres will 16 men cut down in 15 days? Anſ. 120 acres.

11. If 16 men cut down 120 ac. of graſs in 15 days; How many ac. will 4 men cut in 6 days? Anſ. 12 acres.

12. If 12 acres are cut down by 4 men in 6 days; How many men will cut down 120 ac. in 15 days? Anſ. 16 men.

13. If 4 horſes eat 2 bolls of oats in 16 days; How long will 360 bolls ſerve 120 horſes? - Anſ. 96 days.

14. If 24 reapers in 6 days reap 48 acres of wheat; How many acres will 30 reapers reap in 18 days? Anſ. 180 acres.

15. If 24 reapers in 6 days reap 48 acres of wheat; How many reapers will reap 180 acres in 18 days?

16. If 24 reapers in 6 days reap 48 acres; In how many days will 30 reapers reap 180 acres?

17. If 30 reapers in 18 days reap 180 acres; How many acres will 24 reapers reap in 6 days?

18. If 30 reapers in 18 days reap 180 acres; How many reapers will reap 48 acres in 6 days?

19. If 30 reapers in 18 days reap 180 acres; In how many days will 24 reapers reap 48 acres?

20. A ſolid foot of ſtone was 16 inches broad, and 3 inches thick; Req. its length? - - Anſ. 36 inches.

21. If 288 maſons build a wall 180 feet long, 6 high, and 4 thick, in 3 days 10 hours long; In how many days 12 hours long, will 50 maſons build another wall 40 feet long, 10 high, and 3 thick, at the ſame rate of working? - - - - - - - - - - - Anſ. 4 days.

22. When money was at $4\frac{1}{2}$ per cent, I lent my friend L 200 for 60 days; How long may I retain L [illegible] of his money to be indemnified when money is len[illegible]t 5 per cent.? - - - - - - - - - Anſ. 9[illegible]s.

23. If 4 men dig a trench $8\frac{1}{2}$ feet long, $3\frac{1}{2}$ deep, and $2\frac{1}{2}$ broad in $9\frac{1}{3}$ days; In what time will 8 men dig an-

other 25$\frac{1}{2}$ feet long, 7 broad, and 4$\frac{1}{2}$ deep, at the ſame rate of working? - - - - - - - - Anſ. 56 days.

24. How long muſt L 340 be at intereſt to gain L 54 16, at 4$\frac{1}{2}$ per cent. per annum? Anſ. 3 y. 7 m. 15 d.

PROPORTION OF VULG. FRACTIONS.

RULE.—State the terms as in the preceding rule. Prepare the fractions according to the directions given in the reſpective rules, and multiply and divide accordingly.

EXAMPLES.

1. If $\frac{5}{8}$ of a yard coſt L 1$\frac{3}{4}$; What will 8$\frac{4}{5}$ yds. be worth?

a. c. L.

$\frac{5}{8} : \frac{44}{5} :: \frac{7}{4} = \frac{308}{20}$ ($\frac{2464}{100}$ = L 24 12 9$\frac{1}{2}$ $\frac{2}{5}$ Anſ.

2. If 8$\frac{4}{5}$ yds. coſt L 24 12 9$\frac{1}{2}$ $\frac{2}{5}$; What will be the price of $\frac{5}{8}$ of a yard?

a. c. L.

$\frac{44}{5} : \frac{5}{8} :: \frac{118272}{4800} = \frac{591360}{38400}$ ($\frac{2956800}{1689600}$ = L 1 15 Anſ.

3. If 3 yds. coſt L $\frac{7}{9}$; What will be the price of 3 pieces, each containing 36$\frac{3}{5}$ yds.? - Anſ. L 28 9 4.

4. If 109$\frac{4}{5}$ yds. coſt L 28 9 4; How many yds. will L $\frac{7}{9}$ buy? - - - - - - - - - - Anſ. 3 yards.

5. If I pay $\frac{3}{7}$ of a guinea for 4$\frac{3}{7}$ lib. of tea; What quantity, at the ſame rate, may I have for L 8$\frac{5}{8}$? Anſ. 44$\frac{5}{196}$ lib.

6. If I pay $\frac{4}{5}$ of $\frac{5}{7}$ of a guinea for the carriage of 2$\frac{3}{4}$ tons of goods 2$\frac{2}{3}$ miles; Req. the rate per ton each mile?

Anſ. 3$\frac{1}{4}$d. $\frac{19}{35}$.

RULES OF PRACTICE.

TABLE OF ALIQUOT PARTS.

1d. = $\frac{1}{12}$
1$\frac{1}{2}$d. = $\frac{1}{8}$
2d. = $\frac{1}{6}$
3d. = $\frac{1}{4}$
4d. = $\frac{1}{3}$
6d. = $\frac{1}{2}$
of a ſhil.

56 lib. = $\frac{1}{2}$
28 lib. = $\frac{1}{4}$
16 lib. = $\frac{1}{7}$
14 lib. = $\frac{1}{8}$
of a cwt.

3d. = $\frac{1}{80}$
4d. = $\frac{1}{60}$
6d. = $\frac{1}{40}$
8d. = $\frac{1}{30}$
1s. = $\frac{1}{20}$
1s. 8d. = $\frac{1}{12}$
2s. = $\frac{1}{10}$
2s. 6d. = $\frac{1}{8}$
3s. 4d. = $\frac{1}{6}$
4s. = $\frac{1}{5}$
5s. = $\frac{1}{4}$
6s. 8d. = $\frac{1}{3}$
10s. = $\frac{1}{2}$
of a pound.

CASE I.—When the price is any aliquot part of a pound, &c. contained in the table above, divide the given quantity by that part, and the quotient will be the anſwer, in the ſame name of which the price is a part.

EXAMPLES.

1. What is the price of 1748 yds. at 3s. 4d. per yd.?

s. d. L.
3 4 = $\frac{1}{6}$ | 1748
L 291 6 8

2. Cal. 471 yds. at 1d.
3. — 372 yds. at 2d.
4. — 312 yds. at 3d.
5. — 300 yds. at 4d.
6. — 417 yds. at 6d.
7. — 413 yds. at 1s.
8. — 399 yds. at 1s. 8d.
9. — 777 yds. at 2s.
10. Cal. 717 yds. at 2s. 6d.
11. — 815 yds. at 3s. 4d.
12. — 457 yds. at 4s.
13. — 336 yds. at 5s.
14. — 883 yds. at 6s. 8d.
15. — 942 yds. at 6s. 8d.
16. — 999 yds. at 10s.
17. — 904 yds. at 3s. 4d.

Proof. By compound multiplication.

CASE II.—When the price is any even number of ſhillings, multiply the quantity by ½ the price. Double the right hand figure of the product for ſhillings; the reſt will be pounds.

EXAMPLES.

1. Cal. 7443 yds. at 18s.
9
Anſ. L 6698 14

2. Cal. 8441 yds. at 16s.
8
Anſ. L 6752 16

CASE III.—When the price is neither an aliquot part of a pound nor an even number of ſhillings, diſpoſe it into aliquot parts, which work for ſeverally, and the ſum of the quotients will be the anſwer. If the quantity contains a fraction, take proportional parts of the price for it.

EXAMPLES.

1. Cal. 7434 yds. at 17s. 6d.

10	= ½	7434	
5	= ½	3717	
2 6	= ½	1858	10
17 6		929	5
	Anſ. L	6504	15

2. Cal. 4342½ lib. at 15s.

10	= ½	4343		
5	= ½	2171	10	
		1085	15	
			7	6 = ½ lb
	Anſ. L	3257	12	6

3. Cal. 3427 yds. at 3s. 5d.
4. — 4143 yds. at 4s. 7½d.
5. — 1414 yds. at 5s. 11d.
6. — 917 yds. at 7s. 8½d.
7. — 479 yds. at 13s. 8½d.
8. Cal. 841 yds. at 14s. 6d.
9. — 741 yds. at 15s. 4d.
10. — 641 yds. at 17s. 10½d.
11. — 541¼ yds. at 18s. 3d.
12. — 441¾ yds. at 19s. 6d.

Case IV.—When the price conſiſts of pounds, ſhillings, pence, &c. multiply the quantity by the number of pounds, and take parts for the ſhillings, &c. as in the former caſe.

EXAMPLES.

1. Calculate the price of 48 cwt. at L 3 12 6.

		48				
		3				
10	= ½	144	at L	3	0	0
2 6	= ¼	24	at		10	0
		6	at		2	6
	Anſ. L	174	at L	3	12	6

2. Cal. 315 cwt. at L 2 11 6.
3. — 410 cwt. at L 2 17 3.
4. — 511 cwt. at L 4 2 6.
5. Cal. 777 ton at L 11 7 6.
6. — 314 cwt. at L 5 14 6.
7. — 841 ton at L 15 17 9.

Case V.—When the given price is ſo near a pound, or any aliquot part thereof, that it cannot be diſpoſed into aliquot parts, reduce the price to the loweſt denomination it contains; multiply the given quantity thereby, and reduce the product to pounds.

EXAMPLES.

1. Cal. the price of 18735 yds. muſlin, at 9s. $11\frac{3}{4}$ per yard.

$$\begin{array}{r}
119\frac{3}{4} \\
\hline
168615 \\
18735 \\
18735 \\
4683\frac{3}{4} \\
\hline
12\,|\,2234148\frac{3}{4} \\
\hline
2|0\,|\,186179\ \ 0 \\
\hline
\text{Anſ. L}\,9308\ \ 19\ \ 0\frac{3}{4}
\end{array}$$

2. Cal. 417 yds. at 14s. $8\frac{3}{4}$d.
3. — 571 yds. at 14s. $9\frac{3}{4}$d.
4. — 443 yds. at 28s. $11\frac{1}{2}$d.
5. Cal. 1111 yds. at 19s. $1\frac{1}{2}$d.
6. — 721 yds. at 19s. $4\frac{1}{4}$d.
7. — 888 yds. at 19s. $10\frac{1}{4}$d.

CASE VI.—When a troubleſome fraction occurs in the price, multiply the integral part by the denominator, and to the product add the numerator. Work for this product as if it were the real price, but divide the anſwer ſo found by the ſame denominator by which you multiplied for the true anſwer.

EXAMPLES.

1. Cal. the price of 8841 yds. toweling, at $9\frac{4}{5}$d. per yd.

$$\begin{array}{rl|rrr}
3 & 4 = \frac{1}{6} & 8841 & & \\
\hline
 & 8 = \frac{1}{5} & 1473 & 10 & \\
 & 1 = \frac{1}{8} & 294 & 14 & \\
\hline
4 & 1 & 36 & 16 & 9 \\
\hline
 & 5 & 1805 & 0 & 9 \\
\hline
 & \text{Anſ. L} & 361 & 0 & 1\frac{1}{4}\,\frac{1}{5}
\end{array}$$

2. Cal. 7731 yds. at $10\frac{2}{7}$d.
3. — 1472 yds. at $11\frac{3}{7}$d.
4. — 889 yds. at 1s. $1\frac{4}{7}$d.
5. — 484 yds. at 1s. $2\frac{3}{8}$d.
6. — 437 yds. at 1s. $3\frac{2}{5}$d.
7. Cal. 517 yds. at 1s. $2\frac{4}{5}$d.
8. — 663 yds. at 11s. $\frac{4}{5}$d.
9. — 907 yds. at $10\frac{6}{7}$.
10. — 999 yds. at 1s. $4\frac{1}{5}$d.
11. — 904 yds. at 1s. $5\frac{3}{8}$d.

No. I.

Mr James Stark, Cooper,

Bot. of Arnot & Duff,

1798, yds.

Aug. 31. 4 Ps. Scots linen = 120, at 2s. 6d.

3 Do. do. = 96, at 2s. 10d.

7 Do. Iriſh do. = 188, at 2s. 4d.

12 Do. lawns = 208, at 3s. 1d.

9 Do. cheques = 170, at 1s. 1d.

12 Do. linſ. woolſ. = 240, at 1s. 4d.

Amot. L 107 16 2

No. II.

Mr John Nicoll

98, Bot. of Robert Mitchel & Co.

Aug. 31. 148 Pints double whiſky, at 4s. 6d.

345 Do. ſingle do. at 2s. 1d.

708 Do. gin, at 3s. 2d.

1480 Do. coniac brandy, at 8s. 4d.

907 Do. ſhrub, at 3s. 1½d.

72 Do. Jamaica rum, at 7s. 7¼d.

72 Barrels raiſins, at L 2 11 6.

Anſ. L 1152 12 0 7/10

No. III.

Mr Richard Gall, Edinr.

98, Bot. of James Dempſter, hoſier,

Sep. 2. 148 Pairs mens ſilk ſtockings, at 8s. 6d.

274 Do. womens do. at 6s. 4d.

156 Do. childrens do. at 5s.

348 Do. mens worſted do. at 4s. 6d.

397 Do. womens do. at 3s. 9d.

156 Do. childrens do. at 1s. 8d.

414 Do. mens thread do. at 4s. 2d.

200 Do. womens do. at 3s. 9d.

156 Do. childrens do. at 1s. 6d.

400 Yds. velveret, at 4s. 6d.

19 Yds. do. at 3s. 11d.

25 Yds. ſilk ſtriped ſtuffs, at 6s. 2d.

135 Yds. druggets, at 2s. 4d.

200 Reams poſt paper, at 20s. 6d.

E L 847 2 2

No. IV. *A wine merchant's bill.*

Mr Philip Gow, Edinr.

Bot. of Edward Pim.

1799,		
Jan. 1.	16 Gallons palm ſack, at 8s. 6d.	L
	18 Do. red port, at 5s. 9d. - - - -	
	12 Do. claret, at 8s. 10d. - - -	
	36 Do. white Liſbon, at 5s. - - -	
	24 Do. Reniſh, at 6s. 6d. - - -	
	28½ Do. ſherry, at 6s. - - - -	
	9 Do. Madeira, at 6s. 4d. - - -	
	11¼ Do. Malaga, at 8s. - - - -	
		L50 3 6

No. V. *A grocer's bill.*

Mrs Dorothy Drumſticks

Bot. of Peter Pindar,

99,		
Jan. 4.	17½ Lib. bohea tea, at 4s. - -	L
	12 Do. ditto, at 4s. 3d. - - -	
	19¼ Do. congo do. at 4s. 2d. - -	
	12½ Do. green do. at 7s. 6d. - -	
	57 Do. coffee, at 2s. 6d. - - -	
	142 Do. ſugar, at 9¼d. - - - -	
	14 Do. currants, at 8½d. - - -	
	16 Do. raiſins, at 8d. - - - -	
		L28 13 5

No. VI. *A milliner's bill.*

Miſs Faſhionable

Bot. of Eliza Fancy,

99,		
May 3.	21 Yds. fine lace, at 12s. 3d. -	L
	15 Pairs gloves, at 2s. 2d. - - -	
	12 French fans, at 3s. 6d. - - -	
	7 Laced tippets, at 4s. 1d. - - -	
	5 Doz. pair lin. gloves, at 18s. 6d.	
	8 Set of knots, at 2s. 6d. - - -	
	13 Bonnets, at 14s. 6d. - - - -	
	15 Fur tippets, at 9s. 3d. - - -	
	9 Straw bonnets, at 7s. 4d. - -	
	12 Muffs, at 14s. 6d. - - - -	
		L52 0 1

Form of an houſehold account.

1798,		L.	s.	d.	L.	s.	d.
Aug. 1.	To caſh rec. from Mr Sheridan	48	7	8			
2.	By caſh pd for beef - - - -				1	17	6
	By do. pd. for mutton and veal					19	6
	By do. pd. for tea and ſugar -				1	3	7
6.	By do. pd. for 3 counterpanes				6	4	
7.	By do. pd. for coals - - -				3	10	6
12,	By do. pd. the ſhoemaker's ac.				29	14	6
17.	By do. pd. for wine - - -				8	3	1
25.	To do. rec. from Mr Sheridan	30	15	4			
31.	By do. pd. the baker's ac. -				19	10	3
Sep. 3.	By do. pd. for butcher meat -				3	8	6
5.	By do. pd. for 8 rummers -					12	
7.	By do. pd. for 8 ſtones cheeſe				4		
12.	By do. pd. for veal - - - -				1	3	4
	L	79	3	0	80	6	9
					79	3	
Sep. 13. 98.	Bal. due by Mr Sheridan -				L 1	3	9

Form of an account in a merchant's ledger.

	Mr John Paywell, Edinr.	Dr.			Cr.		
98,		L.	s.	d.	L.	s.	d.
Aug. 3.	To 15 lib. tea, at 5s. - - -	3	15				
	To 12 lib. coffee, at 2s. 6d. -	1	10				
	To 10 ſtones cheeſe, at 8s. 6d.	4	5				
13.	To 6 pints whiſky, at 2s. 9d.		16	6			
14.	By caſh rec. to account - -				10		
21.	To 4 doz. oranges, at 1s. 2d.		4	8			
23.	To 9 pints gin, at 3s. 6d. -	1	11	6			
25.	To 10 lib. ſugar, at 1s. 1d. -		10	10			
27.	To 3 lib. currants, at 11d. -		2	9			
31.	By caſh rec. to account - -				2	7	6
Sep. 3.	To 12 doz. bottles, at 2s. 9d.	1	13				
7.	To 18 pints whiſky, at 2s. 10d.	2	11				
18.	By caſh rec. to account - -				1	1	
	L	17	0	3	13	8	6
		13	8	6			
	Bal. due by Mr Paywell -	L 3	11	9			

DECIMAL ARITHMETIC.

1. In decimal fractions the unit is ſuppoſed to be di- ed into 10 equal parts; each of theſe into 10 other equal ts, and each of theſe again into 10 other equal parts; l ſo on *ad infinitum.*

2. A decimal fraction is expreſſed by writing only the nerator with a point prefixed to the left of it, the deno- ıator being known always to conſiſt of an unit with as ny cyphers as the numerator has places. Thus $\frac{3}{10}$ is ex- ſſed by .3; $\frac{4}{100}$ by .04; $\frac{15}{1000}$ by .015; $\frac{1275}{10000}$ by .1275, &c.

3. In the decimal ſcale of notation the figure next to point expreſſes ſo many 10th parts of the integer, the in the ſecond place ſo many 100th parts; and ſo of reſt, ſtill decreaſing the value in a tenfold proportion.

REDUCTION OF DECIMALS.

Prob. I.—To reduce a vulgar fraction to a decimal.

ULE I.—Annex cyphers to the numerator for a di- nd, and divide by the denominator, and the quotient be the decimal ſought.

.—If the denominator cannot be found in the nume- increaſed with one cypher, 0 muſt be the firſt de- l place.

EXAMPLES.

Red. $\frac{1}{8}$ to a decimal. - - $\frac{1000}{8}$ = Anſ. .125
—— $\frac{3}{8}$ to a decimal. - - - - Anſ. .375
—— $\frac{5}{8}$ to a decimal. - - - - Anſ. .625
—— $\frac{1}{4}$ to a decimal. - - - - - Anſ. .25
—— $\frac{5}{16}$ to a decimal. - - - - Anſ. .3125
—— $\frac{7}{35}$ to a decimal. - - - - - Anſ. .2

ıen the ſame figure is repeated ſucceſſively in the ıt, the decimal is called a repetend, and muſt be l with a point above it for diſtinction.

EXAMPLES.

ed. $\frac{1}{3}$ to a decimal. - - $\frac{1000}{3}$ = Anſ. $.33\dot{3}$
— $\frac{2}{3}$ to a decimal. - - - - - - Anſ. $.66\dot{6}$
— $\frac{2}{9}$ to a decimal. - - - - - - Anſ. $.22\dot{2}$

4. Red. $\frac{4}{9}$ to a decimal. - - - - - Anſ. .44$\dot{4}$
5. —— $\frac{1}{24}$ to a decimal. - - - - - Anſ. .041$\dot{6}$
6. —— $\frac{3}{45}$ to a decimal. - - - - - Anſ. .06$\dot{6}$6

When the ſame figures in the quotient recur after certain rotation, the decimal is called a circulate, and the firſt and laſt of the recurring figures muſt be marked with points above them.

EXAMPLES.

1. Red. $\frac{1}{7}$ to a decimal. $\frac{1000000}{7}$ Anſ. .$\dot{1}4285\dot{7}$
2. —— $\frac{1}{11}$ to a decimal. - - - - - Anſ. .$\dot{0}\dot{9}$
3. —— $\frac{3}{14}$ to a decimal. - - - Anſ. .2$\dot{1}4285\dot{7}$
4. —— $\frac{1}{84}$ to a decimal. - - - Anſ. .01$\dot{1}9047\dot{6}$
5. —— $\frac{4}{41}$ to a decimal. - - - - Anſ. .$\dot{0}975\dot{6}$
6. —— $\frac{2}{85}$ to a decimal. Anſ. .$\dot{0}2352941176470588\dot{2}$

Prob. II.—To reduce the inferior denominations of any given integer to the decimal of that integer.

Rule I.—Reduce the given denominations to the vulgar fraction of the integer required.

II.—Reduce as directed in Prob. I. Or when there are ſeveral denominations, begin at the loweſt, and reduce them in their due order till you arrive at the integer required.

EXAMPLES.

1. Red. 1s. 4½d. to the decimal of a pound ſterling.

```
96|0)660(.06875 Anſ.           4|20
     840          Or thus.   12|45
      720                    2|0|1375
       480                  Anſ. .06875
```

2. Red. 6½d. to the decimal of a pound. Anſ. .02708$\dot{3}$
3. —— 17s. 6¾d. to the dec. of a pound. Anſ. .878125
4. —— 19s. 8d. to the dec. of a guinea. Anſ. .$\dot{9}3650\dot{7}$
5. —— 4s. 6d. to the dec. of a crown. - Anſ. .9

6. Red. 7 oz. 9 dwt. 12 grs. to the dec. of a lib. Troy. Anſ. .62291$\dot{6}$
7. —— 3 qrs. 14 lib. to the dec. of a cwt. Anſ. .875
8. —— 2 qrs. 3 nails to the dec. of a yd. Anſ. .6875
9. —— 5 fur. 21 p. to the dec. of a mile. Anſ. .690625

Prob. III.—To find the value of a decimal in the known parts of the integer.

Case I.—When the decimal is finite.

Rule.—Multiply the given decimal by its equivalent in the next inferior denomination, and point off from the product as many figures to the right as the given decimal has places. Continue the operation till you have gone through all the ſubdiviſions of the integer.

EXAMPLES.

1. Req. the value of .21875 parts of a pound ſterling?

Anſ. 4s. 4½d.

$$\begin{array}{r} 20 \\ \hline 4.37500 \\ 12 \\ \hline 4.50000 \\ 4 \\ \hline 2.00000 \end{array}$$

2. Value .0975 of a pound ſterling. Anſ. 1s. 11¼d.
3. —— .4735 of a pound ſterling. - Anſ. 9s. 5½d.
4. —— .875 of a cwt. - - - Anſ. 3 qrs. 14 lib.
5. —— .7475 of a lib. Troy. Anſ. 8 oz. 19 dwt. 9 grs.
6. —— .6875 of a yard. - - - Anſ. 2 qrs. 3 nails.
7. —— .99375 of a ton. Anſ. 19 cwt. 3 qrs. 14 lib.
8. —— .25 of a guinea. - - - - Anſ. 5s. 3d.
9. —— .875 of an acre. - - Anſ. 3 roods, 20 falls.

Case II.—When the decimal terminates in a repetend.

Rule.—Carry at 9 in the product of the repetend, and when a cypher occurs on the right of the multiplier, annex the repetend for it.

EXAMPLES.

1. Value $.430208\dot{3}$

$$\begin{array}{r} .430208\dot{3} \\ 20 \\ \hline 8.604166\dot{6} \\ 12 \\ \hline 7.2500000 \\ 4 \\ \hline 1.0000000 \end{array}$$

Anſ. 8s. 7¼d.

2. Value $.17\dot{3}$ of a pound ſterling. - Anſ. 3s. 5½d.
3. —— $.88\dot{3}$ of an acre. - Anſ. 3 r. 13 f. 12 ells.
4. —— $.581\dot{3}$ of a chalder. Anſ. 9 bolls, 1 fir. 3 lip.
5. —— $.171\dot{3}$ of a cwt. - - - - Anſ. 19 lib.
6. —— $.1994\dot{6}$ of a guinea. - - Anſ. 4s. 2¼d.

CASE III.—When the decimal terminates in a circle.

RULE.—To the product of the laſt figure of the circle add the 10's in the product of the firſt figure of the circle into the ſame multiplier; then multiply in the common way till the whole value be obtained.

EXAMPLES.

1. Required the value of $.6696\dot{4}2857\dot{1}$ of a cwt.?

$$\begin{array}{r} 4 \\ \hline 2.6785\dot{7}1428\dot{5} \\ 28 \\ \hline 54285\dot{7}1428\dot{6} \\ 135714285714 \\ \hline 19.0000000000 \end{array}$$

Anſ. 2 qrs. 19 lib.

2. Value $.\dot{9}2063\dot{4}$ of a guinea. - - Anſ. 19s. 4d.
3. —— $.910\dot{7}1428\dot{5}$ of a cwt. - Anſ. 3 qrs. 18 lib.
4. —— $.982\dot{1}4285\dot{7}$ of a cwt. - Anſ. 3 qrs. 26 lib.
5. —— $.295\dot{6}3492\dot{0}$ of a hhd. Anſ. 18 gal. 5 pints.
6. —— $.7993827160\dot{4}$ of a moidore. Anſ. 21s. 7d.

BY INSPECTION.

Rule.—Double the figure next to the point; and if the next figure be 5 or above, add 1 thereto for ſhillings; then the figure in the ſecond place if below 5, or its ſurplus above 5 with the figure in the third place, make ſo many farthings; and for every 25 in the ſum 1 muſt be deducted, and the remainder will be the anſwer in pence and farthings.

EXAMPLES.

1. Value .8995 of a L by inſpection. Anſ. 17s. 11¾d.
2. —— .975 of a L. - - - - - - Anſ. 19s. 6d.
3. —— .745 of a L. - - - - - - Anſ. 14s. 11d.
4. —— .715 of a L. - - - - - - Anſ. 14s. 3¾d.
5. —— .075 of a L. - - - - - - - Anſ. 1s. 6d.
6. —— .009 of a L. - - - - - - Anſ. 2¼d.

To reduce ſhillings, pence, and farthings to the decimal of a pound ſterling by inſpection.

Rule.—Take half the number of ſhillings for the firſt decimal place; then the number of farthings in the remainder increaſed by 1 if it amounts to 24 or upwards; by 2 if to 48 or upwards; and by 3 if to 72 or upwards; will be the two next decimal places.

EXAMPLES.

1. Red. 14s. 8¼d. to the decimal of a L. Anſ. .734
2. —— 15s. 7½d. to the decimal of a L. Anſ. .781
3. —— 19s. 9¼d. to the decimal of a L. Anſ. .988
4. —— 3s. 5¾d. to the decimal of a L. Anſ. .174

ADDITION OF DECIMALS.

Rule.—Arrange the given numbers by placing the decimal points exactly under each other; then on the left will be integers, and on the right decimals; and when all the decimals are finite, add as in integers, and let the decimal point in the ſum range with thoſe above.

Ex. (1.)	(2.) Red. and add as under.				
74.825	L 741	15	6	=	L 741.775
9.45	375	13	3	=	375.6625
.38135	94	12	9	=	94.6375
4.000725	4	13	6	=	4.675
14.15	0	9	6	=	.475
1.05	54	1	6	=	54.075
.0713475					
103.9284225	L 1271	6	0	=	L 1271.3...

CASE II.—When all or any of the given decimals repeat.

RULE.—Give all the repetends the ſame number of places, and 1 more than the largeſt finite. Carry at 9 in the right hand column; but in all the reſt carry at 10.

Ex. (1.)	(2.)				
$73.\dot{3}33333$	L 14	13	4	=	L $14.6666\dot{6}$
84.675	17	6	8	=	$17.3333\dot{3}$
$34.1\dot{6}6666$	9	3	4	=	$9.1666\dot{6}$
$89.7\dot{3}3333$	74	19	11	=	$74.9958\dot{3}$
$94.38141\dot{6}$	13	13	8	=	$13.6833\dot{3}$
376.28975.					

CASE III.—When all or any of the decimals terminate in a circle.

RULE.—Make all the circles ſimilar and conterminous; find the number of tens in the firſt column of the circle, which add with the right hand column; then proceed as in finite decimals, only carry at 9 in the right hand column.

Note. Diſſimilar circles may be made ſimilar by finding the leaſt common multiple of the number of places in the given circles, and extending each circle to as many places as the multiple contains units.

EXAMPLE.

Diſſimilar.	Made ſimilar; 6 being the leaſt common multiple of 2 and 3.
$.\dot{7}\dot{4}$	$.\dot{7}4\dot{7}474$
$.\dot{3}5\dot{4}$	$.\dot{3}5\dot{4}354$
$.\dot{5}\dot{9}$	$.\dot{5}9\dot{5}959$
$.\dot{3}\dot{8}$	$.\dot{3}8\dot{3}838$
$.\dot{9}1\dot{4}$	$.\dot{9}1\dot{4}914$
	2.996544

Reduce and add cwt. qrs. lib.

4	3	18 =	$4.910\dot{7}1428\dot{5}$
9	3	26 =	$9.982\dot{1}4285\dot{7}$
31	2	18 =	$31.660\dot{7}1428\dot{5}$
3	3	10 =	$3.839\dot{2}8571\dot{4}$
7	2	26 =	$7.732\dot{1}4285\dot{7}$
Cwt. 58	0	14 =	58.125……

SUBTRACTION OF DECIMALS.

Rule.—Arrange the factors as in addition; and when both are finite, ſubtract as in integers.

EXAMPLES.

(1.) 741.843275
341.9454125
399.8978625

(2.) 78.000000075
9.12345
68.876550075

Reduce and ſubtract as under.

L175 15 0 = L175.75
89 17 6 = 89.875
Anſ. L85 17 6 = 85.875

L447 13 6 = L447.
329 14 9 = 329.
Anſ. L117 18 9

Case II.—If both, or only one of the factors repeat.

Rule.—Make the repetends conterminous in the firſt inſtance, and extend the repeating factor one place farther than the finite one in the ſecond. In both caſes borrow at 9 in the right; but no where elſe.

EXAMPLES.

(1.) $96.4378\dot{3}$
$14.7121\dot{6}$
Anſ. $81.7256\dot{6}$

(2.) 71.7385
$34.9478\dot{3}$
Anſ. $36.7906\dot{6}$

Reduce and ſubtract as under.

L775 13 4 = L $775.66\dot{6}$
427 15 8 = $427.78\dot{3}$
L347 17 8 = L $347.88\dot{3}$

CASE III.—When either, or both factors terminate in a circle, prepare them as in addition; and if the figure in the left hand column of the circle in the ſubtrahend be greater than the figure in the ſame place in the minuend, add 1 to the right hand figure of the ſubtrahend, before ſubtraction.

EXAMPLES.

	Diſſimilar.	Made ſimilar.
(1.)	$897.\dot{4}\dot{5}$	$897.\dot{4}5454\dot{5}$
	$\underline{547.\dot{5}6\dot{2}}$	$\underline{547.\dot{5}6256\dot{2}}$
		Anſ. 349.891982

$$\begin{array}{rr}
(2.) & 348\tfrac{4}{13} = 348.\dot{3}0769\dot{2} \\
& 219\tfrac{9}{11} = \underline{219.\dot{8}\dot{1}8181} \\
& \text{Anſ. } 128.489510
\end{array}$$

MULTIPLICATION OF DECIMALS.

RULE I.—When the decimals are finite, find the product as in integers, and from the right point off as many places as are in both factors. If the product has not ſo many figures, prefix cyphers on the left, to make up the complement.

EXAMPLES.

$$\begin{array}{rr}
(1.) & 74.3475 \\
& \underline{30.25} \\
& 3717375 \\
& 1486950 \\
& \underline{2230425} \\
& 2249.011875
\end{array}
\qquad
\begin{array}{rr}
(2.) & 314.2865 \\
& \underline{.00235} \\
& 15714325 \\
& 9428595 \\
& \underline{6285730} \\
& .738573275
\end{array}$$

RULE II.—If one of the factors be finite, and the other repeat, multiply by the finite factor, and carry at 9 in the right hand column; make the products conterminous, and in adding carry at 9 on the right. If the multiplier has cyphers on the right, continue the repetend for them in the product.

EXAMPLES.

(1.)
$9746.5\dot{3}$
8.075
$487326\dot{6}$
$6822573\dot{3}$
$779722666\dot{6}$
$78703.2566\dot{6}$

(2.)
$3125.15\dot{6}$
$.00015$
$1562578\dot{3}$
$3125156\dot{6}$
$.4687735$

Rule III.—When one of the factors is finite, and the other a circulate, multiply by the finite, and for each 10 in the product of the left hand figure of the circle add 1 to the product of the right hand figure of the circle by every multiplier; then multiply as in finite decimals, and prepare and add according to the rule given in addition of circulates.

EXAMPLES.

(1.)
$3.\dot{4}216\dot{7}$
53.05
1710837
102650226
1710837108
181.5198174

(2.)
$4.3\dot{5}64\dot{2}$
$.00045$
2178212
17425702
$.0019603915$

Rule IV.—When both factors repeat, reduce the repetend in the multiplier to a vulgar fraction, and take proportional parts of the multiplicand for it, after multiplying by the finite part as in Rule II.

EXAMPLES.

Mul. $874.31\dot{6}$ by $74.8\dot{3}$
$74.8\frac{1}{3}$
6994533
34972666
612021666
$291438 = \frac{1}{3}$
65428.0305

Or thus.
$874.31\dot{6}$
$74\frac{5}{6}$
$3497266\dot{6}$
$61202166\dot{6}$
$728597\dot{2} = \frac{5}{6}$
65428.0305

Rule I.—When both factors are finite, proceed as in integers, and point off ſo many places for decimals in the *quotient*, as with thoſe in the diviſor, may exactly equal the number of decimal places in the dividend.

EXAMPLES.

(1.) 7.55)874.5(115.827
1195
4400
6250
2100
5900
615

(2.) 6.75)842.5(124.814
(3.) 345)99.74(.2891
(4.) .1234)7.472(60.551
(5.) .005)9.975(1995.

Rule II.—When the diviſor is finite, and the dividend repeats, divide as before; but after the dividend is exhauſted, the diviſion may be continued at pleaſure, by annexing the repeating figure to the remainder.

EXAMPLES. Quotients.

(1.) 4.5)$99.1\dot{6}$($22.\dot{0}3\dot{7}$
91
166
316
1

(2.) $75.\dot{3}$ ÷ 1.5 = $50.\dot{2}$
(3.) $9.1\dot{6}$ ÷ 2.5 = $3.\dot{6}$
(4.) $9.9\dot{3}$ ÷ 9.8 = $1.013\dot{6}$
(5.) $84.\dot{6}$ ÷ .05 = $1693.\dot{3}$

Rule III.—When the diviſor is finite, and the dividend a circulate, the diviſion may be continued to any length by dividing as uſual, and annexing the figures in the circle ſucceſſively to the remainder.

EXAMPLES.

(1.) 13.85)$94.\dot{7}3\dot{6}$(6.84019
11636
5567
2736
13517
1052

(2.) $.\dot{4}9\dot{5}$ ÷ 2.5 = $.\dot{1}9\dot{8}$
(3.) $.\dot{7}4\dot{1}$ ÷ 9.75 = $.0\dot{7}\dot{6}$
(4.) $.\dot{8}\dot{9}$ ÷ 4.5 =
(5.) $.\dot{1}2\dot{7}$ ÷ .94 =

Rule IV.—When the diviſor repeats, multiply both diviſor and dividend by ſome digit that will exterminate the repetend in the diviſor.

EXAMPLES. Anſwers.

(1.) $4.8\dot{3})74.151($
$3 \quad 3$
$14.5)222.453(15.34158$
774
495
603
230
850
1250
90

(2.) $47.8 : 1.1\dot{6} = 40.97$
(3.) $475 \div 2.1\dot{6} = 217.69$
(4.) $999 \div 3.1\dot{3} = 318.82$
(5.) $91.74 \div 3.\dot{3} = 27.522$
(6.) $148.5 \div 1.2\dot{4} = 119.3\dot{3}$
(7.) $473.5 \div 7.\dot{3} = 64.5681$

APPLICATION OF DECIMALS.

EXAMPLES.

1. How many ſquare feet are contained in a floor whoſe length is 25 feet 8 inches, and breadth 18 feet 6 inches?

$25.\dot{6}$
18.5
$128\dot{3}$
$2053\dot{3}$
$2566\dot{6}$
Anſ. $474.8\dot{3}$=474f. 10in.

Or thus.

$25.\dot{6}$
$18\frac{1}{2}$
$2053\dot{3}$
$2566\dot{6}$
$128\dot{3}$
Anſ. $474.8\dot{3}$ the ſame.

2. There is a piece of mahogany 16 feet 8 inches long, 5 feet 3 inches broad, and 4 feet 4 inches thick; Req. its ſolidity and price, at 9d. per foot?

Anſ. $379.1\dot{6}$ ſol.—Price L. 14 4 4½.

3. Req. the ſolidity of a block of marble whoſe dimenſions are 6 feet 8 inches, 5 feet 9 inches, and 4 feet 2 inches? - - - - - - - Anſ. 159.72 cub. feet.

4. There is a box 5 feet 9 inches long, 4 feet 4 inches wide, and 3 feet 9 inches deep; Req. its tonnage and freight, at L 2 7 6 per ton? - - Anſ. L 5 10 11$\frac{1}{4}$.

5. A lady ſettled L 40 per annum on 4 poor widows, G, P, D, and H; directing G to draw $\frac{1}{3}$, P $\frac{1}{4}$, D $\frac{1}{5}$, and H $\frac{1}{6}$. What ſum did each draw?

$\frac{1}{3} = .\dot{3}33$
$\frac{1}{4} = .25$
$\frac{1}{5} = .2$
$\frac{1}{6} = .1\dot{6}6$ $\frac{1}{3}$ $\frac{1}{4}$ $\frac{1}{5}$ $\frac{1}{6}$

$.95)40.(42.105263$
14.035087 = L 14 0 8$\frac{1}{2}$ G.
10.526315 = 10 10 6 P.
8.421052 = 8 8 5$\frac{1}{4}$ D.
7.017543 = 7 0 4$\frac{1}{4}$ H.
Proof L 40. . . . . . . L 40 0 0$\frac{0}{4}$ proof.

6. A ciſtern that has 12 unequal cocks can be emptied by the firſt in an hour; by the ſecond in 2 hours; and ſo on to the laſt, which will empty it in 12 hours; In what time will it be emptied if all run together?

Anſ. 19 min. 19 ſec.

PROPORTION APPLIED TO PARTNERSHIP.

Case I.—When each partner is concerned only to a certain extent.

Rule.—As the total ſtock : each partner's particular ſtock, : : the total dividend : each partner's ſhare.

EXAMPLES.

1. Three partners, A, B, C, trade in company. A's ſtock was L 400; B's L 600; and C's L 200. They have a dividend of L 527 profit; What ſum muſt each draw?

A L 400
B 600
C 200

1200 : 400 :: 527 : $175.6\dot{6}$ A.
: 600 :: 527 : 263.5 B.
: 200 :: 527 : $87.8\dot{3}$ C.
L 527... proof.

2. Four partners, D, E, F, G, trade in company. D advances L 500; E L 800; F L 900; and G L 1200. They gain L 780; What ſum does each draw?

3. 500 Acres of waſte land is to be divided among 4 gentlemen, H, I, K, L, in proportion to their valuations. H's valued rent is L 400; I's L 350; K's L 1280; and L's L 710; How many acres will each receive?

4. A ſhip and cargo worth L 30000 being entirely loſt at ſea, of which $\frac{1}{3}$ belonged to M, $\frac{1}{4}$ to N, $\frac{1}{5}$ to O, and the reſt to P; What loſs will each ſuſtain ſuppoſing L 1650 to be recovered by inſurance?

5. Four partners, A, B, C, and D, purchaſe a ſugar-work, of which A paid $\frac{3}{8}$, B $\frac{1}{7}$, C $\frac{2}{10}$, and D paid L 205 12; What was D's ſhare; what did the work coſt; and what did A, B, and C each contribute towards the purchaſe?

CASE II.—When the times of the partners capitals in trade are unequal.

RULE.—As the ſum of the products of the capitals into their reſpective times : each particular product, :: the whole dividend : each partner's ſhare of the dividend.

EXAMPLES.

1. A's capital of L 450 was 4 months in trade; B's of L 170 was 8 months; and C's of L 800 was 5 months. They gain L 533 14 6; What ſum is each partner entitled to draw?

A L 450 × 4 = 1800
B 170 × 8 = 1360
C 800 × 5 = 4000 L.
7160 : 1800 :: 533.725 : 134.1766 A.
: 1360 :: 533.725 : 101.3779 B.
: 4000 :: 533.725 : 298.1703 C.
Proof L 533.725.

2. Four partners, A, B, C, and D, trade in co. A's capital of L 800 was in trade 9 months; B's of L 800 was 11 months; C's of L 500 was 4 months; and D's of L 300 was 12 months. They gain L 1000; What falls to the ſhare of each?

3. A on the 1ſt of Jan. put into company L 1200; B could advance nothing till 1ſt June; What ſum muſt he then advance to entitle him to an equal ſhare of the profits at the year's end?

As 7 : 12 :: 1200 : L 2057 2 10¼ Anſ.

4. Two partners, A and B, enter into partnerſhip for 21 months. A puts in L 500, and at the end of 9 months puts in L 200 more, and at the end of 17 months puts in L 50 more; B puts in L 1500, and at the end of 7 months takes out L 1000, and at the end of 13 months puts in L 900. Their profits amount to L 630 12 4; What ſum does each receive at the ſettlement?

5. A undertakes to finiſh a piece of work in 40 days, for L 5 15; but finding the taſk too heavy, agrees with B after 28 days labour to work along with him, for which he was to be paid proportionally; What did B receive?

Anſ. L 1 6 6¼.

PROPORTION APPLIED TO PROFIT AND LOSS.

Case I.—The prime coſt and profit or loſs upon it given, to find the gain or loſs per cent.

Rule.—As the prime coſt : the profit or loſs, :: L 100 : the rate per cent.

EXAMPLES.

1. Bought cloth at 12s. and ſold it at 14s.; What did I gain per cent.?

PROFIT AND LOSS.

a. c.

As 12 : 2 :: 100 : $16\frac{2}{3}$ per cent. Anſ.

2. Bought ſugar at L. 3 15 per cwt. and ſold it at L 4 2; What did I gain per cent.? - - Anſ. $9\frac{1}{3}$ per cent.

3. Bot. a ſilver watch at 6 guineas, and ſold it at L 6; What did I loſe per cent.? - - Anſ. $4\frac{16}{21}$ per cent.

CASE II.—When a certain rate per cent. is propoſed to be gained or loſt.

RULE.—As 100 : 100 with the rate per cent. added in caſe of gain, and deducted in caſe of loſs, :: the prime coſt : the ſelling price.

EXAMPLES.

1. Bought cloth at 8s. upon which I would have 16 per cent. profit; What muſt I ſell it at?

a. c. s. s. d.

As 100 : 116 : 8 : 9 $3\frac{1}{4}\frac{11}{25}$ Anſ.

2. Bot. a horſe at L 15; What muſt I ſell him at to gain 30 per cent.? - - - - - - Anſ. L 19 10.

3. Bot. a quantity of yarn at 3s. 4d. per ſpindle; but getting it damaged, I am willing to loſe 6 per cent.; What muſt I charge per ſpindle? - Anſ. 3s. $1\frac{1}{2}$d. $\frac{1}{25}$.

CASE III.—When the ſelling price and rate per cent. profit or loſs are given, to find the prime coſt.

RULE.—As 100 with the rate added or deducted : 100 :: the ſelling price : the prime coſt.

EXAMPLES.

1. Sold cloth at 15s. per yd. upon which I had 20 per cent. profit; What was the prime coſt?

a. c. s. s. d.

100 + 20 = 120 : 100 :: 15 : 12 6 Anſ.

2. Sold cloth at 18s. per yd. on which I had $13\frac{1}{4}$ per cent. profit; What did I buy it at? Anſ. 15s. $10\frac{3}{4}$d.

3. Sold cloth at 7s. by which I loſt 4 per cent.; What did I buy it at? - - - - - - - Anſ. 7s. $3\frac{1}{2}$d.

4. Sold a piano-forte at 22 guineas, by which I loſt 12 per cent. whereas in the courſe of trade I ſhould have gained 20 per cent.; How much was it ſold under value? Anſ. 8 guineas.

CASE IV.—To find a proportional rate on *one* advanced price by having *another*, and the rate on it given.

RULE.—As the price whoſe rate per cent. is given : the price whoſe rate per cent. is required, :: 100 with the given rate added in caſe of gain, or deducted in caſe of loſs, : 100 added to the required rate in the firſt inſtance, and to 100— the required rate in the ſecond.

EXAMPLES.

1. Sold cloth at 5s. per yd. upon which I had $12\frac{1}{2}$ per cent. profit; but markets riſing, I ſold what remained at 6s.; What did I clear per cent. by my laſt ſales?

a. c.

As 5 : 6 :: 112.5 : 135—100=35 per cent. Anſ.

2. Sold flax-ſeed at 18d. per lip. on which I had 30 per cent. profit; but the market taking an unfavourable turn, I ſold what remained at 14d.; What had I per cent. on my laſt ſales? - - Anſ. $1\frac{1}{9}$ per cent. profit.

3. Sold goods at 10s. per yd. on which I loſt 2 per cent. I ſold the ſame goods afterwards at 12s.; What per cent. had I then? - - Anſ. $17\frac{3}{5}$ per cent. profit.

4. Sold yarn at 40d. per ſpindle, on which I had 5 per cent. profit. I ſold the ſame afterwards at 32d.; What per cent. was loſt or gained on the laſt ſales?

Anſ. 16 per cent. loſt.

PROPORTION APPLIED TO BARTER.

RULE.—Firſt write down the given quantity, and by a compariſon of the two prices, arrange the terms as is taught in the rule of proportion.

EXAMPLES.

1. How many hats, at 18s. each, may I have in barter for 423 yds. linen, at 4s. per yd.?

a. c. yds. hats. Or thus, decimally. hats.

18 : 4 :: 423 : 94 Anſ. 423×.2÷.9=94 Anſ.

2. How many pieces of ſilk, at L 3 15, may I have in barter for 25 cwt. 3 qrs. of Riga flax, at L 2 a cwt.? - - - - - - - - - - - Anſ. $15\frac{9}{20}$

3. How many pairs of ſhoes, at 5s. 3d. may I have in barter for 756 yds. of cheque, at 1s. 4d. per yard?
Anſ. 192 pairs.

4. What quantity of nutmegs, at L.5 12 per cwt. may be given in barter for 75 cwt. 3 qrs. 12 lib. tobacco, at 1s. 3d. per lib.? - - - - - - - Anſ. 32.321 cwt.

5. How many bolls of wheat, at 21s. may be given in barter along with L.20 for 8800 ſtones hay, at 4d. per ſtone? - - - - Anſ. 126 bolls, 2 fir. 2$\frac{10}{63}$ pecks.

6. X receives from R 380 yds. linen at 5s. and gives him 96 lib. tea at 4s. 6d. and a certain quantity of raiſins at 8d. per lib.; Req. the quantity of raiſins?
Anſ. 2202 lib.

TARE AND TRETT.

1. *Groſs weight* is the weight both of the commodity and package, ſuch as caſk, bag, box, &c.

2. *Tare* is an allowance on weighable goods made at the cuſtomhouſe to the importer, and by the ſeller to the buyer, for the outſide package above mentioned.

3. *Trett* is an allowance of 4 lib. per 104 lib. certain, granted for break, waſte, &c. on ſuch goods as are ſold by the lib. weight.

4. *Clough* or *Cloff*, is an allowance of 2 lib. on every 3 cwt. after tare and trett are deducted, to turn the ſcale when goods are re-weighed.

5. *Suttle weight* is what remains after the tare is deducted from the groſs.

6. *Nett weight* is what remains after all the propoſed allowances are made.

Case I.—When the tare is inſerted in the invoice along with the groſs weight.

Rule.—Subtract the tare from the groſs, and the remainder will be the nett weight.

EXAMPLES.

1. What is the nett of 4 hhds. tobacco; contents of groſs and tare as under?

	Groſs. cwt.	qrs.	lib.		Tare. cwt.	qrs.	lib.
No. 1.	15	3	14	=	0	3	25
2.	17	3	18	=	1	0	1
3.	14	1	19	=	0	2	10
4.	18	3	26	=	1	0	16
Total groſs	67	0	21		3	2	24
Total tare	3	2	24				
Anſ.	63	1	25 nett weight.				

2. What is the nett of 25 bags cotton yarn, each weighing 2 cwt. 3 qrs. 14 lib. groſs; tare 9 lib. per bag? Anſ. 69 cwt. 3 qrs. 13 lib.

Case II.—When the tare is at a certain rate per cwt.

Rule.—Take aliquot parts for the tare; which ſubtract from the groſs, and the remainder will be the nett weight.

EXAMPLES.

1. What is the nett of 412 cwt. 3 qrs. 14 lib. groſs; tare 18 lib. per cwt.?

	cwt.	qrs.	lib.	
16 lib.=⅐	412	3	14	
2 lib.=⅛	58	3	26	
	7	1	13¾	
	66	1	11¾	tare.
Anſ. cwt.	346	2	2¼	nett weight.

2. What is the nett of 456 cwt. 1 qr. 14 lib. groſs; tare 17 lib. per cwt.? - - Anſ. 387 cwt. 11¼ lib.

3. Req. the nett and price of 8 hhds. tobacco, each weighing 2 cwt. 3 qrs. 4 lib. groſs; tare 15 lib. per cwt. and price L 2 7 6 per cwt.?

Anſ. 19½ cwt. nett=L 46 6 3.

Case III.—When there is an allowance both of tare and trett.

Rule.—Deduct the tare from the groſs as in the foregoing rule, and divide the remainder or ſuttle by 26, for the trett; which being deducted from the ſuttle, leaves the nett weight required.

EXAMPLE.

Req. the nett of 318 cwt. 2 qrs. 18 lib. groſs; tare 16 lib. per cwt. and trett 4 lib. per 104 lib.?

16 lib. = $\frac{1}{7}$ | 318 2 18 groſs.

45 2 2$\frac{4}{7}$ tare.

26) 273 0 15$\frac{3}{7}$ ſuttle.

10 2 0$\frac{4}{7}$ trett.

Anſ. 262 2 14$\frac{6}{7}$ nett.

Case IV.—When tare, trett, and cloff are all allowed.

Rule.—Deduct the tare and trett as in the former Caſe, and divide the remainder or ſubſuttle by 168, for the cloff; which being deducted from the ſubſuttle, the remainder will be the nett weight.

EXAMPLE.

What is the nett of 148 cwt. 1 qr. 12 lib. groſs; tare 14 lib. per cwt., trett as uſual, and cloff the common allowance of 2 lib. per 3 cwt.?

14 lib. = $\frac{1}{8}$ | 148 1 22 groſs.

18 2 5 tare.

26) 129 3 7 ſuttle.

4 3 27$\frac{5}{26}$ trett.

168) 124 3 7$\frac{21}{26}$ ſubſuttle.

2 27$\frac{5}{26}$ cloff.

Anſ. 124 0 8$\frac{16}{26}$ nett.

FACTORAGE.

When one perſon tranſacts buſineſs for another, a certain premium or *commiſſion-money* is allowed him by his employer, which is generally at ſome fixed rate per cent.; and the perſon ſo employed is ſtyled a FACTOR.

Rule.—As L 100 : rate, : : the given ſum : the premium or commiſſion. Or work by aliquot parts.

EXAMPLES.

1. Bought goods for my employer to the amount of L 7480 9 6; What is my commiſſion thereon at 6 per cent.?

a. c. L. s. d. L. s. d.

As 100 : 6 : : 7480 9 6 : 448 16 6¾ Anſ.

Practically.

5 = $\frac{1}{20}$	7480	9	6		
1 = $\frac{1}{5}$	374	0	5$\frac{1}{2}$.8	com. at 5	per cent.
	74	16	1$\frac{0}{4}$.56	—— at 1	
Anſ.	L 448	16	6$\frac{3}{4}$.36	—— at 6	

2. My factor adviſes, that he has ſold goods on my account to the amount of L 775 13 4, and negotiated bills to the value of L 400 6 8; What is his commiſſion at 1$\frac{3}{4}$ per cent.? - - - - - - - - - - Anſ. L 20 11 7.

3. If a factor is allowed 4 guineas per cent.; What may he demand for diſburſing L 3400 15?

Anſ. L 142 16 7$\frac{1}{2}$.

INSURANCE, OR SECURITY FROM LOSS.

Note. It is uſually an article in the policy of inſurance, that in caſe of loſs the inſurer is to be allowed a ſmall diſcount, commonly 2 per cent.; ſo that the inſured receive only L 98 of the L 100; and this L 98 is called the ſhort recovery.

Case I.—The ſum inſured and rate per cent. given; to find the premium.

Rule.—Compute as in factorage.

EXAMPLES.

1. What premium muſt be paid for inſuring L 1250 at the rate of 7 per cent.?

a. c. L. L. s.
As 100 : 7 : : 1250 : 87 10 Anſ.

2. Inſured at the *Phœnix fire-office* on my tenement in Caſtle-ſtreet to the value of L 900; What muſt I pay annually at 1$\frac{1}{2}$ per cent. to keep the policy in force?

Anſ. L 13 10.

Case II.—The ſum inſured and rate of diſcount given; to find the ſhort recovery.

Rule.—As L 100 : L 100 — the diſcount, : : the ſum inſured : the ſhort recovery.

EXAMPLES.

1. What is the ſhort recovery of L 2500; diſcount being allowed at 2 per cent.?

As 100 : 98 : : 2500 : 2450 ſhort rec. Practically.

$2 = \frac{1}{50}$ | 2500

50

Anſ. L 2450 ſhort rec.

2. The Rattleſnake, bound for Halifax, being loſt at ſea, on which I had inſured L 3480; What ſum do I recover, diſcounting at 2 per cent.? Anſ. L 3410 8.

Case III.—The rates per cent. of the premium and diſcount, and the real value at riſk given; to find what ſum muſt be inſured to cover the whole outſet on a ſingle voyage, &c. That is, to recover from the underwriters the whole value at riſk, including premium and diſcount.

Rule.—Subtract the ſum of the premium and diſcount from L 100. Then, as the remainder : L 100 : : the value at riſk : the anſwer.

EXAMPLES.

1. What ſum muſt be inſured to cover L 200; premium 8 per cent. and 2 per cent. diſcount in caſe of loſs?

a. c. L. L. L. s. d.

190—10=90 : 100 : : 200 : 222.2=222 4 $5\frac{1}{3}$ Anſ.

2. If the premium be $12\frac{1}{2}$ per cent. and the diſcount 2; What ſum muſt be inſured to cover L 990 15?

Anſ. 1158 15 $5\frac{1}{4}$.

3. I am to inſure at London L 1000, premium 8 guin. per cent.; at Edinburgh L 800, prem. $8\frac{1}{2}$ guin. per cent.; and at Aberdeen L 600, prem. $8\frac{3}{4}$ guin. per cent.; Req. the ſum to be inſured to cover the above ſums in their reſpective places, 2 per cent. being allowed in each in caſe of loſs?

Anſ. { L 1116 1 $5\frac{1}{7}$ at London.
898 2 $4\frac{1}{4}$ at Edinr.
675 11 $7\frac{1}{4}$ at Aberd.

This rule, by the help of ſuppoſed numbers, finds a true anſwer to many intricate queſtions, and was in high repute before the knowledge of algebra became ſo common; and though not ſo univerſally practiſed now, yet it ſtill continues to be of great uſe.

SINGLE POSITION.

When the anſwer can be obtained by one ſuppoſition.

RULE.—As the reſult is to the poſition, :: the given number : the anſwer.

EXAMPLES.

1. A ſchoolmaſter being aſked how many ſcholars he had, anſwered, if I had as many, half as many, and one-eight as many, I ſhould have 315; How many had he?

Sup. 64	Then 168 : 64 :: 315 : 120 Anſ.	
64		120
32		60
8		15
168	Proof	315

2. A perſon's age being aſked, made anſwer, that if to $\frac{1}{6}$ part of his age you add 6 times his age, the ſum would be 480; What was his age?

Anſ. 77 years, 10 mo. 3 w. 23 h. 21 m. $4\frac{33}{37}$ ſec.

3. A farmer being aſked how many lambs he had, anſwered, if I had $\frac{1}{2}$ as many, $\frac{1}{3}$ as many, and $\frac{1}{4}$ as many, I ſhould have 2000; How many had he? Anſ. 960.

4. A general gave the following account of the number of his army, viz. that 4 times as many, $\frac{1}{2}$ as many, $\frac{1}{6}$ as many, and $\frac{1}{12}$ as many, would make 171000; Req. the number of his army? - - - - Anſ. 36000 men.

5. A perſon's age being aſked, replied, if $\frac{2}{7}$ of the years I have lived be multiplied by 7, and $\frac{5}{7}$ of this product divided by 3, the quotient will be 40; Req. his age?

Anſ. 60 years.

6. A gentleman bought a phæton, horſe and harneſs, for L 120. The horſe was valued at twice as much as the harneſs, and the phæton at double both horſe and harneſs; Req. the value of each?

		L	s	d
Anſ.	Harneſs	13	6	8
	Horſe -	26	13	4
	Phæton	80	0	0
	Proof	120	0	0

7. A ciſtern that holds 800 gallons has 4 unequal cocks; and by opening the 1ſt it will be emptied in an hour; by opening the 2d in two hours; the 3d in 3 hours; and the 4th in 4 hours; In what time will it be emptied if all run together? - - - Anſ. 28 min. 48 ſec.

DOUBLE POSITION.

When any queſtion is ſo involved that a ſimple diviſion cannot be adapted to all the conditions of it, it may be reſolved by two ſuppoſitions.

Rule I.—Take any two convenient numbers, and proceed with each according to the conditions of the queſtion; and find the differences betwixt the reſults and given numbers, which call errors.

II.—Multiply each of theſe errors into the other's poſition; and if both errors are of the ſame kind, i. e. both *leſs*, or both *greater* than the given number, divide the difference of the products by the difference of the errors.

III.—If the errors are not of the ſame kind, i. e. if the one be *greater*, and the other *leſs* than the given number, divide the ſum of the products by the ſum of the errors; the quotient in either caſe will be the anſwer.

EXAMPLES.

1. Three partners, A, B, and C, bought a ſhip which coſt L 2000; of which A paid a certain ſum unknown; B paid as much as A and L 50 more; and C paid as much as them both and L 25 more; What did each pay?

1ſt. Sup.		2d. Sup.	
A pd.	L 500	A pd.	L 400
B - -	550	B - -	450
C -	1075	C - -	875
	2125		1725
	2000		2000
Error	125 of exceſs.	Error	275 defect.

Then 500 × 275 = 137500
400 × 125 = 50000
400)187500(468.75 pd. by A,
518.75 —— B, Anſ.
1012.5 —— C,
Proof 2000...

2. A perſon in play loſt $\frac{1}{4}$ of his money, and then won 3s.; after which he loſt $\frac{1}{3}$ of what remained, and won 2s.; laſtly he loſt $\frac{1}{7}$ of what he ſtill had, and found he had 12s. remaining; What ſum had he at firſt? Anſ. L 1.

3. At a certain election 375 perſons voted, and the candidate choſen had a majority of 191; How many voted for each?

Anſ. 231 the one.
142 the other.

4. A certain man took his ſwine to market, viz. hogs, ſows, and pigs, and received for them in all L 50. The price of each hog was 18s. each ſow 16s. and each pig 2s. Moreover, there were as many hogs as ſows; and for every ſow there were 3 pigs; Req. the number of each?

Anſ. 25 hogs, 25 ſows, and 75 pigs.

5. A gentleman caught a fiſh whoſe head was 6 inches long; the tail was as long as the head and half the body; and the body juſt the length of the head and tail; Req. the particulars?

Anſ. Length of the fiſh 48
—— body 24 inches.
—— tail 18

6. A gentleman has two horſes, Sprightly and Courſer: Now, a ſaddle worth L 50 ſet on the back of Sprightly will make his value double that of Courſer, but when ſet on the back of Courſer will make his value triple that of Sprightly; Req. the value of each horſe?

Anſ. Sprightly L 30.
Courſer - 40.

SIMPLE INTEREST.

DEF. I.—*Principal* is the ſum lent.

II.—*Intereſt* is the premium allowed for the loan.

III.—*Amount* is the ſum of both principal and intereſt.

IV.—*Rate* is ſo much per cent. per annum.

Prob. I.—*To compute the intereſt of any ſum, for any number of days, at any rate per cent. per annum.*

Rule.—Multiply the principal by the number of days it is at intereſt, and divide the product by 7300, and the quotient will be the intereſt at 5 per cent. which may be reduced to any other rate by multiplying ⅕ of the intereſt ſo found by the rate propoſed; or the continued product of the principal, number of days, and double the rate, divided by 73000, will quote the intereſt at any rate per cent.

EXAMPLES.

1. Req. the intereſt of L 400 for 65 days, at 5 per cent. per annum?

$$\begin{array}{r} 400 \\ \underline{65} \\ 7300)26000(3\ \ 11\ \ 2\tfrac{3}{4} \end{array} \quad \begin{array}{l} \\ \text{L. s. d.} \\ \text{Anſ.} \end{array}$$

2. Req. the int. of L 450 10 for 65 days, at 5 per cent. per annum? - - - - - - - Anſ. L 4 0 2¾.

3. ———————— L 460 for 32 days, at 4¾ per cent.? Anſ. L 1 18 5¾.

4. ———————— L 552 12 for 41 days, at 4½ per cent.? - - - - - - - - - - Anſ. L 2 15 10¼.

5. ———————— L 10 15 for 135 days, at 4½ per cent.? - - - - - - - - - - - Anſ. 3s. 4½d.

6. ———————— L 12 19 for 212 days, at 4 per cent.? Anſ. 6s.

7. ———————— L 917 9 from 4th Jan. to 19th Aug. at 3½ per cent.? - - - - - - - Anſ. L 19 19 4¾.

Prob. II.—*To compute the intereſt of any ſum, at any rate, for any number of years, months, days, &c.*

Rule.—Divide the continued product of the principal, rate, and time, by 100, and the quotient will be the anſwer.

EXAMPLES.

1. What is the intereſt of L 194 for 7 years and 3 months, at 5 per cent. per annum?

$$\frac{194 \times 5 \times 7.25}{100} = \text{L } 70\ 6\ 6 \text{ Anſ.}$$

2. Req. the int. of L 440 for $3\frac{1}{2}$ years, at $3\frac{1}{2}$ per cent.? Anſ. L 53 18.

3. ———————— L 700 15 for 11 yrs. 200 days, at $4\frac{1}{2}$ per cent.? - - - - - - - - - Anſ. L 364 3.

4. ———————— L 225 10 for 6 yrs. 41 days, at 5 per cent.? - - - - - - - - - - Anſ. 68 18 4.

5. ———————— L 3000 for 15 yrs. 4 mo. at $4\frac{1}{4}$ per cent.? - - - - - - - - - - Anſ. L 1955.

6. ———————— L 444 4 for 4 yrs. 44 days, at 4 per cent.? - - - - - - - - - Anſ. L 73 4 $3\frac{3}{4}$.

7. ———————— L 303 13 for 5 yrs. 113 days, at $3\frac{3}{4}$ per cent.? - - - - - - - - - Anſ. L 60 9 $2\frac{1}{4}$.

Prob. III.—To compute the intereſt on bills, bonds, &c. when partial payments are made at no great intervals.

Rule.—Multiply the principal and ſeveral balances in their due order by the number of days they are at intereſt, and divide the ſum of theſe products by 7300, and the quotient will be the legal intereſt.

EXAMPLES.

1. Suppoſe a bill of L 630 to be due on Jan. 14; L 200 of which is paid March 12; L 120 April 17; and the balance May 24; How much intereſt is due, reckoning at 5 per cent.?

Amount per bill, due Jan. 14.		L 630×57=35910
March 12. Paid to account	- -	200
	Bal. -	430×36=15480
April 17. Do.	- - - - - -	120
	Bal. -	310×37=11470
May 24. Paid the bal.	- - - -	310 73|00)62860
	- - - - -	Anſ. L 8 12 $2\frac{1}{2}$

2. A bill of L 708 was due on Feb. 14; of which L 172 was paid on March 13; L 110 on April 17; L 49 on May 5; L 81 on June 26; L 103 on July 4; and the balance on Aug. 21; What intereſt is due on the bill?

Prob. III.—*To compute the intereſt on caſh accounts, or any other ſpecies of progreſſive accounts where partial payments are made, or partial debts contracted.*

Rule.—Multiply the ſeveral balances into the days they are at intereſt in the order of their dates; and if the balance be ſometimes due to the one party, and ſometimes to the other, extend the products in ſeparate columns. Laſtly, divide the ſum of the products by 7300 for the intereſt, at 5 per cent.

EXAMPLES.

1. Required the intereſt and balance on the following caſh account, from Jan. 1. to Dec. 7. at 5 per cent.?

Dr. Mr G. Gibb's acct. currt. with Mr R. Stark Cr.

1798,		L.			L.
Jan. 1.	To caſh drawn	150	Feb. 3.	By caſh rem.	160
Feb. 28.	To caſh do.	110	Apr. 14.	By caſh do.	170
April 3.	To caſh do.	219	—— 23.	By caſh do.	200
May 1.	To caſh do.	412	May 5.	By caſh do.	120
—— 22.	To caſh do.	45	—— 28.	By caſh do.	510
July 25.	To caſh do.	427	June 13.	By caſh do.	50
Aug. 27.	To caſh do.	104	Aug. 3.	By caſh do.	40
Oct. 14.	To caſh do.	300	Sep. 7.	By caſh do.	108
—— 29.	To caſh do.	32	Dec. 7.	By caſh do.	300

1798,		L.	ds.	drafts.	rem.
Jan. 1.	Drawn by Gibb - -	150	33	4950	
Feb. 3.	Remitted by do. - -	160			
	Bal. due by - -	10	25		250
—— 28.	Drawn - - - - -	110			
	Bal. to - - -	100	34	3400	
Apr. 3.	Drawn - - - - - -	219			
	Bal. to - - -	319	11	3509	
—— 14.	Remitted - - - -	170			
	Bal. to - - -	149	9	1341	
	Carried over -	-	112	13200	250

		L.	ds.	drafts.	rem.
1798,	Bal. brought forward	149	112	13200	250
Apr.23.	Remitted by Gibb -	200			
	Bal. due by - -	51	8		408
May 1.	Drawn - - - - - -	412			
	Bal. to - - -	361	4	1444	
— 5.	Remitted - - - - - -	120			
	Bal. to - - -	241	17	4097	
—22.	Drawn - - - - - -	45			
	Bal. to - - -	286	6	1716	
—28.	Remitted - - - - -	510			
	Bal. by - - -	224	16		3584
June 13.	Remitted - - - - -	50			
	Bal. by - - -	274	42		11508
July 25.	Drawn - - - - - -	427			
	Bal. to - - -	153	9	1377	
Aug. 3.	Remitted - - - - -	40			
	Bal. to - - -	113	24	2712	
—27.	Drawn - - - - - -	104			
	Bal. to - - -	217	11	2387	
Sep. 7.	Remitted - - - - -	108			
	Bal. to - - -	109	37	4033	
Oct.14.	Drawn - - - - - -	300			
	Bal. to - - -	409	15	6135	
—29.	Drawn - - - - - -	32			
	Bal. to - - -	441	39	17199	
Dec. 7.	Remitted - - - - -	300			
	Bal. to - - -	141		54300	15750

15750

Princ. due by Gibb L 141 0 0 7300|38550

Int. due by do. - 5 5 7¼ L 5 5 7¼

Anſ. L 146 5 7¼ due by Gibb to Stark.

2. Req. the intereſt and balance on the following caſh account for a year, allowing 5 per cent. when the balance is due to the bank, and only 3½ when due by the bank.

Dr. Mr A. Swan's acct. currt. with Mr J. Young Cr.

1799.		L.			L.
Jan. 1.	To cash drawn	98	Feb. 2.	By cash rem.	74
Mar. 3.	To cash do.	540	Apr. 4.	By cash do.	100
May 4.	To cash do.	400	June 19.	By cash do.	1700
Aug. 5.	To cash do.	170	Sep. 3.	By cash do.	300
Oct. 7.	To cash do.	1010	Nov. 4.	By cash do.	90
Dec. 8.	To cash do.	330	Dec. 31.	By cash do.	142

1799,		L.	ds.	drafts.	
Jan. 1.	To cash drawn - -	98	32	3136	
Feb. 2.	By do. remitted -	74			
	Bal. to - - -	24	29	696	
Mar. 3.	To do. drawn - -	540			
	Bal. to - - -	564	32	18048	
Apr. 4.	By do. remitted -	100			
	Bal. to - - -	464	30	13920	
May. 4.	To do. drawn - -	400			
	Bal. to - - -	864	46	39744	
June 19.	By do. remitted -	1700			
	Bal. by - -	836	47		39292
Aug. 5.	To do. drawn - -	170			
	Bal. by - -	666	29		19314
Sep. 3.	By do. remitted -	300			
	Bal. by - -	966	34		32844
Oct. 7.	To do. drawn - -	1010			
	Bal. to - - -	44	28	1232	
Nov. 4.	By do. remitted -	90			
	Bal. by - -	46	34		1564
Dec. 8.	To do. drawn - -	330			
	Bal. to - - - -	284	23	6532	
— 31.	By do. remitted -	142	73)	833.08	93014
	Bal. due J. Y. banker	142	L	11 8 3	7
				73	651.098
					L 8 18 4½

	L	s	d
Princ. due the bank	L 142	0	0
Int. due do. - - - -	11	8	3
Total -	L 153	8	3
Int. due by the bank	8	18	4½
Bal. due J. Y. banker	L 144	9	11½

Prob. V.—When partial payments are made on bills or bonds at intervals greater than a year.

Rule.—Add the intereſt due at each payment to the principal, and deduct the payment from the amount.

EXAMPLES.

1. A bond of L 540 was due on Aug. 13, 1793; of which there was paid on March 19, 1794, L50; Dec. 19, 1795, L52; Sep. 23, 1796, L48; Aug. 15, 1797, L 139; Oct. 21, 1798, L 220; Req. the balance due on Jan. 3, 1800?

Aug. 13, 93. Principal per bond - - -	L 540.
Int. to Mar. 19, 94=218 days - -	16.126
Amount -	556.126
Mar. 19, 94. Paid to account - - - - -	50.
1ſt Balance -	506.126
Int. to Dec. 19, 95=1 year, 275 days	44.372
Amount -	550.498
Dec. 19, 95. Paid to account - - - - -	132.
2d Balance -	418.498
Int. to Sep. 23, 96=278 days - - -	15.937
Amount -	434.435
Sep. 23, 96. Paid to account - - - - - -	48.
3d Balance -	386.435
Int. to Aug. 15, 97=326 days - -	17.257
Amount -	403.692
Aug. 15, 97. Paid to account - - - - -	139.
4th Balance -	264.692
Int. to Oct. 21, 98=1 year, 67 days -	15.663
Amount -	280.355
Oct. 21, 98. Paid to account - - - - -	220.
5th Balance -	60.355
Int. to Jan. 3, 1800=1 year, 74 days	3.629
Anſ.	L 63.984

2. Borrowed per bond, dated May 14, 1752, the ſum of L 2000, bearing legal intereſt, upon which I have made the following partial payments, viz.

L 250

515

700

120

445

1100

[illegible]

[illegible]

[illegible]

F. [illegible] the first day

[illegible] 270 19 5¼

M

[illegible] any sum, due at

Ap [illegible] ought to be

May [illegible] worth.

June [illegible] the rate and

Aug

[illegible] and

Sep. [illegible] the

Oc.

[illegible]

Nov.

[illegible] worth

Dec.

31 [illegible] 701

Dec. [illegible] worth

du

Ju [illegible]

Ju [illegible]

Prob. VII.—To find the time in which any given ſum will amount to any other ſum, at any rate per cent.

Rule.—As the intereſt of the given principal for 1 year, at the given rate : 1 year, : : the whole intereſt : the time required.

EXAMPLES.

1. In what time will L 600 become L 640, at 5 per cent.?
30 : 1 : : 40 : 1.3=1 year, 4 mo. Anſ.

2. In what time will L 840 become a ſtock of L 900, at 5 per cent.? Anſ. 1 year, 5 mo. 4 days.

PRACTICAL METHOD OF DISCOUNTING BILLS.

Bankers that keep money for the purpoſe of diſcounting bills, generally add three days of grace to the time the bill has to run, and calculate the intereſt for the whole. Some likewiſe charge a ſmall commiſſion for their trouble, which, with the intereſt, they deduct from the content of the bill, and pay the balance to him for whom the diſcount is made.

EXAMPLES.

1. A bill of L 420, payable Aug. 2, is preſented at the bank for diſcount on April 7; What ſum does the banker pay after deduction of intereſt and ½ per cent. commiſſion?

```
½=1/200|420
       |120
       |-----
  73|00|50400
       ------
        6.904 intereſt.
        2.1   commiſſion.
       ------
        9.004
       ------
Anſ. L 410.996=L 410 19 11
```

2. Diſcounted A B's bill of L 320 18 on June 3, payable October 19, for which received ½ per cent. commiſſion; What ſum muſt he receive? Anſ. L 313 17 11½.

3. What ready money will take up a bill of L 500, payable 73 days hence, allowing ⅓ per cent. commiſſion? Anſ. L 494.

4. A bill of L 89 10, payable at 107 days diſtance, is to be diſcounted; What ſum will the porteur receive, reckoning legal intereſt? Anſ. L 88 3 9.

COMPOUND INTEREST.

Compound intereſt is that which ariſes from both principal and intereſt taken together, at the end of each ſtated time when the intereſt becomes due.

Rule.—Multiply the amount of L 1 for a year into itſelf as often as there are years propoſed, abating 1; then the laſt product multiplied by the principal will give the amount; and if from the amount you ſubtract the principal, the remainder will be the compound intereſt.

EXAMPLES.

1. Req. the amount of L 400 for 4 years, compound intereſt, at 5 per cent. per annum?

```
                                        L.
        1.05                       20|400
        1.05          Or thus.        20
        ----                       ------
         525                       20|420=1ſt year.
        105                            21
      ------                       ------
      1.1025                       20|441=2d year.
        1.05                         2205
      ------                     --------
       55125                   20|463.05=3d year.
      11025                        231525
    --------                     --------
    1.157625          Anſ. L 486.2025=4th year.
        1.05
    --------
     5788125
    1157625
  ----------
  1.21550625
         400
  ----------
Anſ. L 486.2025....
```

2. What is the amount of L 700 forborn 5½ years, at 5 per cent. per annum, compound intereſt? Anſ. L 904 11 3¼.

Note. When there are months, &c. beyond complete years, take proportional parts of the amount for even years, which, added, will give the amount. *See the Key to the Text Book.*

3. What will L 500 amount to in 12 years and 9 months, at 5 per cent. per annum, compound intereſt?

Anſ. { L.931 12 amount.
431 12 intereſt.

EQUATION OF PAYMENTS.

When a debt becomes due at different periods of time, the finding of a mean time at which the whole may be diſcharged, without loſs to either party, is called equating the terms of payment.

RULE I.—Multiply the ſeveral payments into their reſpective times, and divide the ſum of the products by the ſum of the payments; the quotient will be the equated time nearly.

EXAMPLES.

1. The ſum of L 800 was to have been paid as under, viz. L 300 at 4 months; L 400 at 9 months; and the remaining L 100 at 12 months; but the parties agree to pay the whole off at once; Req. the equated time?

300 × 4 = 1200
400 × 9 = 3600
100 × 12 = 1200
800 |6000

Anſ. 7.5 = 7½ mo. the equated time.

2. L 1200 is to be paid as follows, viz. L 150 at 2 months; L 300 at 3 months; L 400 at 6 months; L 250 at 10 months; and the balance at 12 months; Req. the equated time when the whole may be paid without prejudice to either party? - - - - - - - Anſ. 6.083 months.

3. Bought a certain quantity of goods on credit; and, according to bargain, was to pay ½ of the price at the end of every 3 months, till the whole ſhould be diſcharged:

Now, I wiſh to pay the whole at one time; Req. the equated time? - - - - - - - - Anſ. 7½ months.

Note. The foregoing rule is not ſtrictly true; for if a perſon retains money in his hand after it becomes due, he gains the *intereſt* of it for the time; but if he pays money before it is due, he loſes only the *diſcount*, which is always leſs than the intereſt by the intereſt of the diſcount for the time. But as this error is ſo trifling, the above is generally uſed in buſineſs: Yet thoſe who chooſe to be nice in calculation may take the following,

Rule II.—Firſt, find the preſent worth of each debt; then find in what time the ſum of the preſent worths will amount to the ſum of the debts. Let Ex. 1ſt be reſumed.

106 : 100 :: 300 : 295.0819672 ⎫
103.75 : 100 :: 400 : 385.5421686 ⎬ preſent worths.
105 : 100 :: 100 : 95.2380952 ⎭
775.862231

100 : 5 :: 775.862231 : 38.78311155 = 1 year's intereſt.

1 year's int.		whole int.		mo.		mo.	w.	d.	h.	
38.78311155	:	24.137769	::	12	:	7	1	6	2,	true time.

Hence, the true equated time is found to be 7 months, 1 week, 6 days, and 2 hours, which is only 22 hours ſhort of the equated time by Rule 1ſt, and is no great conſideration in the courſe of a year.

EXCHANGE OF MONEY.

Def. I.—*Exchange* is the trade of money carried on between different countries, by giving money or value in the one, and receiving a bill or draught on the other.

II.—*The courſe of exchange* is the rate at which bills are bought or ſold.

III.—*Par* is the intrinſic value of any piece of money in one country compared with that of another.

IV.—*Agio* is the difference betwixt *bank* and *current* money in foreign countries.

V.—*Uſance* is a certain fixed time agreed on between two places for the payment of bills of exchange.

I.—*With LONDON.*

Rule.—Work by practice.

EXAMPLES.

1. A merchant in Edinburgh drew on his correſpondent in London for L 418 10; premium $\frac{3}{4}$ per cent.; How much was paid for the bill at Edinburgh?

$$\begin{array}{l|l} \frac{1}{2} = \frac{1}{200} & 418.5 \\ \frac{1}{4} = \frac{1}{2} & 2.0925 \\ & 1.04625 \\ \hline \end{array}$$

Anſ. L 421.63875 = L 421 12 $9\frac{1}{4}$

2. Glaſgow drew on London for L 1000; premium $\frac{1}{2}$ per cent.; What did the bill coſt at Glaſgow?

Anſ. L 1005.

3. A merchant in Aberdeen is indebted to his friend in London to the amount of L 3000; What will it coſt him to procure bills on London for the amount; exchange at $\frac{1}{4}$ per cent.? - - - - - - - Anſ. L 3007 10.

4. A merchant in Glaſgow owes his correſpondent in Mancheſter L 444 4; What will a London bill for the amount coſt him; premium $\frac{1}{5}$ per cent.? Anſ. L 445 1 9.

II.—*With IRELAND.*

In Ireland accounts are kept as in Britain, and the par of L 100 ſterling is L 108 6 8; but the courſe or price of bills is variable, and generally runs between 6 and 12 per cent.

Prob. I.—To reduce Iriſh to ſterling.

Rule.—As L 100 with the courſe added : L 100 :: the given Iriſh : the required ſterling.

EXAMPLES.

1. In L 384 Iriſh, How much ſterling; exch. at 109?
As 109 : 100 :: 384 : L 352 5 $10\frac{1}{4}$ Anſ.

2. In L 704 15 Iriſh, How much ſterling; exch. at 110? - - - - - - - - - Anſ. L 640 13 $7\frac{1}{4}$.

3. Gained a prize of L 2000 Iriſh in the Iriſh lottery; For how much may I draw when the exchange is at 107?

H 2 Anſ. L 1869 3 2.

Prob. II.—To reduce ſterling to Iriſh.

Rule.—As L 100 : L 100 with the courſe added, : : the given ſterling : the required Iriſh.

EXAMPLES.

1. In L 770 12 ſterling, How much Iriſh; exch. at 108?
2. In L 901 17 ſterl. How much Iriſh; exch. at 106?
3. A merchant in Edinburgh remits to his correſpondent in Dublin L 880 ſterling; For how much Iriſh will he be credited there; exch. 110? - - Anſ. L 968.

III.—*With AMERICA and the WEST INDIES.*

In America accounts are kept as in Britain, only their money is called currency. The courſe of exchange is fluctuating, but always inferior to ſterling.

Prob. I.—To reduce currency to ſterling.

Rule.—As the equivalent currency of L 100 : the given currency, : : L 100 : the required ſterling.

EXAMPLES.

1. Philadelphia remits to Britain per bill L 640 9 currency; How much ſterling will the bill amount to when the exchange is 165 per cent.?

a. c. currency. ſterling.
As 165 : 100 : : 640.45 : 388 3 3½ Anſ.

2. In L 9475 10 Jamaica currency, How much ſterling; exch. at 140 per cent.? - Anſ. L 6768 4 3¼.
3. When a mechanic receives 6s. 6d. per day at Philadelphia, and in Britain only 2s. 6d. What is the difference of the wages per day; exch. 165 per cent.?

Anſ. Better at Philadelphia by 1s. 5½d. ſterl. per day.

4. A horſe was ſold at New-York for L 215 currency; Req. the amount in ſterling when the exchange is 180 per cent.? - - - - - - - - Anſ. L 119 8 10½.
5. An Edinr. merchant in balancing his books finds there is due him in Jamaica L 3440 8 cur. exch. 145; in St Kitt's L 880 cur. exch. 148; in Virginia L 1400 cur. exch. 155; in New-York L 998 15 cur. exch. 154

per cent.; What ſum ſtands in the ſterling column of his ledger? - - - - - - - Anſ. L 4519 0 11¼.

Prob. II.—To reduce ſterling to currency.

Rule.—As L 100 ſterling : the given ſterling, : : the equivalent currency : the required currency.

EXAMPLES.

1. Boſton remits to Britain per bill L 640 12 ſterling; How much currency did the bill coſt at Boſton; exch. at 170 per cent.? - - - - - Anſ. L 1080 0 4¾.

2. A merchant in Glaſgow ſhips off for Virginia goods to the amount of L 997 17 ſterling; For how much currency will he have credit in Virginia when the exchange rates at 160 per cent.? Anſ. L 1596 11 2½.

3. A trading company in Glaſgow conſign to their factor in New-York goods to the amount of L 5000 ſterling, prime coſt at Glaſgow. The goods were ſold at 96 per cent. advance on the invoice currency for ſterling; Req. the amount in cur. when the exchange is at 140 per cent.? - - - - - - - - Anſ. L 13720 cur.

4. A gentleman in Britain purchaſed an eſtate of 15000 acres of land in Kentucky, at L 625 ſterling; Req. the price per acre in ſterling and in currency when the exch. is at 176 per cent.? Anſ. 10d. ſterl. and 17¼d. ⅔ cur. per ac.

5. An American merchant conſigned to his factor in Greenock 648 hhds. of flax-ſeed, which he ſold at L 3 ſterling per hhd.; How much currency muſt the factor remit after deducting his own commiſſion at 2½ per cent. and L 15 for cellar rent, &c. when the exchange is at 154 per cent.? - - - - Anſ. L 2896 7 10¼ cur.

IV.—With HOLLAND.

In Holland there are two ſorts of money, viz. *bank* and *currency*. The bank is generally rated from 3 to 6 per cent. better than the current; and bills of exchange are always negotiated in bank. The par of L 1 ſterl. is 36s. 6d. Flemiſh banco; and the courſe runs from 30 to 40 ſchil. per pound ſterling.

				Value in ſterling.		
16 Penninge	=	1 Stiver	=	L 0	0	$1\frac{7}{73}$
20 Stivers	=	1 Guilder	=	0	1	$9\frac{3}{4}\frac{48}{73}$
6 Guilders	=	1 Pound Flem.	=	0	10	$11\frac{1}{2}\frac{2}{73}$
2 Guilders	=	1 Dollar	=	0	3	$7\frac{3}{4}\frac{29}{73}$
$2\frac{1}{2}$ Guilders	=	1 Rixdollar	=	0	4	$6\frac{3}{4}\frac{13}{73}$
$5\frac{1}{4}$ Guilders	=	1 Ducat	=	0	9	$7\frac{5}{73}$

2 Grotes or pence Flem. = 1 Stiver.
40 Grotes - - - - - = 1 Guilder.
12 Grotes - - - - - = 1 Schilling.
80 Grotes - - - - - = 1 Dollar.
240 Grotes - - - - - = 1 Pound Flem.

PROB. I.—To reduce currency to banco.

RULE.—As L100 + agio : 100 : : currency : banco; and to reduce banco to currency, the contrary.

EXAMPLES.

1. In 8040 current guilders, How much banco; agio 4 per cent.? a. c. cur. banco.
104 : 100 : : 8040 : 7730.769 Anſ.
2. In 9054 cur. guil. How much banco; agio 3 per cent.? - - - - - - - - - Anſ. 8790.291 b. g.
3. Red. 1234 cur. guil. to banco; agio 5.
4. —— 7744 ban. guil. to cur. agio 3. Anſ. 7976.32.

PROB. II.—To reduce Dutch or Flemiſh money to ſterling.

RULE.—As the equivalent Dutch : the given Dutch, : : L1 ſterling : the required ſterling; and to reduce ſterling to Dutch, the contrary.

EXAMPLES.

1. In L875 15 Flemiſh banco, How much ſterling; exch. at 36s. 8d. per pound ſterling? Anſ. 477 13 $7\frac{1}{2}$.
2. In L7854 14 Flemiſh cur. How much ſterling; exch. at 37s. 6d. and agio 4 per cent.? Anſ. L4028 1 $0\frac{3}{4}$.
3. Red. 7400 guilders banco to ſterl. exch. at 35s. 9d. Anſ. L689 19 $6\frac{1}{4}$.
4. Leith is indebted to Amſterdam in 8172 guilders banco; How much ſterl. will pay the debt; exch. 37s. 9d.?

5. Dundee remits to Rotterdam L 726 8; Req. the amount in current guilders; exch. 37s. 3d. and agio 4?

Anſ. 8442.2208 cur. guil.

6. A merchant in Edinburgh owes his correſpondent in Amſterdam L 1556 7 4 Flemiſh; How much ſterling will pay the debt when the exch. is at 34s. 9d.?

Anſ. L 895 15.

7. When the exch. is at 38s. 6d. What is the value of the bank guilder? - - - - - - Anſ. 1s. 8¾d. $\frac{54}{77}$.

8. When the exch. is at par, What is the ſterl. value of the Flemiſh pound? - - - - - Anſ. 10s. 11½d.

9. When the guilder banco ſells at Edinburgh for 22½d. What is the courſe of exch. betwixt Britain and Holland?

Anſ. 35s. 6½d.

10. If the pay of a Britiſh ſailor be L 1 12 per month, and that of a Dutch ſailor 16 guilders; Which of the two has the advantage when the exch. is at 37s. 6d.?

Anſ. The Britiſh ſailor is better by 3s. 6d. ſterling.

11. When the exch. is at 37s. 6d. What is the value of the bank guilder?

Flem. Flem. ſterl. ſterl.

$1.875 : 1 :: 1 : .5\dot{3}$ = L 1 Flem.

Then $.5\dot{3} \div 6 = .0\dot{8}$ = 1s. 9¼.3d. Anſ.

V.—With HAMBURG.

In Hamburgh accounts are kept in marc-lubs, or *marcs of Lubeck*, ſchilling-lubs, and phennings. The agio runs from 15 to 40 per cent.

Exch. with { *Britain*, at ſo many ſchil. groſs per L ſterl.
Holland, about 33 ſtiv. ban. per dol. of Ham.
France, about 26 ſchil. lubs per ecu.

					Value in ſterling.		
12	Phennings	=	1 Schilling-lub	=	L 0	0	1⅛
16	Schilling-lubs	=	1 Marc-lub	=	0	1	6
7½	Marc-lubs	=	1 Pound Groſs	=	0	11	3
2	Marc-lubs	=	1 Dollar	=	0	3	0
3	Marc-lubs	=	1 Rixdollar	=	0	4	6
6¼	Marc-lubs	=	1 Ducat	=	0	9	4½

Rule.—Reduce the Hamburg money to Flemiſh; then compute as with Holland.

EXAMPLES.

1. Hamburg is indebted to Edinburgh in L 400 ſterling; How many marcs muſt be paid in Hamburg when the exch. is 34s. 6d. Flemiſh banco per pound ſterling?

Flem. Flem. marcs. marcs.
As 1 : 1.725 :: 7½ : 12.9375 in L 1 ſterling.
400
Anſ. 5175 .... marc-lubs.

Note. As 40 grotes make a guilder of Holland, and 32 grotes a marc of Hamburg; therefore, guilders multiplied by 5 and divided by 4, make marcs; and marcs multiplied by 4 and divided by 5, make guilders.

2. In 7480 marc-lubs banco, How much ſterling, when the exch. is at 33s. 6d. Flemiſh banco per pound ſterling? - - - - - - - - - Anſ. L 595 8 5½.

3. In L 87 4 9, How many marc-lubs cur. agio 20, and exch. 33s. 10d. Flemiſh banco per pound ſterling?
Anſ. 1328.1908 marcs.

4. Hamburg is indebted to Britain in 4056 marcs, 8 ſchil. lubs; Req. the amount in ſterl. when the exch. is at 34s. 3d. Flemiſh banco per pound ſterling?
Anſ. L 315 16 8¼.

5. Leith is indebted to Hamburg in 3344 ſchil. lubs; How much ſterling will pay the debt when the exch. is at 34s. 3d. Flemiſh banco per pound ſterling?
Anſ. L 16 5 5¼.

6. In 840 marc-lubs cur. agio 30, and 340 rixdollars cur. agio 25, How much ſterl. exch. 35s. 8d. Flemiſh banco per pound ſterling? - - Anſ. L 110 15 1¼.

7. When the exch. is at 34s. 6d. Flemiſh banco per pound ſterling, Req. the value of the marc lub banco?

F. Flem. m. marcs. d. s. d.
As 1 : 1.725 :: 7.5 : 12.9375)240(1 6½ Anſ.

8. When the exch. is 34s. 9d. Flem. ban. What is the value of the marc-lub. cur. agio 25? Anſ. 1s. 2¼d.

9. A Dundee merchant conſigned to his factor in

Hamburg 480 gallons whiſky, which were ſold at 5 marcs, 8 ſchil. per gallon; 560 gallons rum, at 9 marcs, 10 ſchil. per gallon; and 98 cwt 3. qrs. ſugar, at 42 marcs, 12 ſchil. per cwt. The freight, duty, &c. amounted to 400 marcs; Req. the Hamburg bill of ſales; and the ſterling to be remitted by the factor, allowing him 2 per cent. commiſſion; exch. 35s. 6d. Flem. ban. per pound ſterling? - Anſ. 12251.5625 marcs = L 872 9 $6\frac{1}{4}$.

VI.—With FRANCE.

The French keep accounts in livres, ſols, and deniers.

				Value in ſterling.		
12 Deniers	=	1 Sol	=	0	0	$0\frac{1}{2}$
20 Sols	=	1 Livre	=	0	0	10
3 Livres	=	1 Ecu or Crown Tournois	=	0	2	6
10 Livres	=	1 Piſtole	=	0	8	4
24 Livres	=	1 Louis-d'or	=	1	0	0

Exch. with { *Britain* on the ecu; par $29\frac{1}{2}$d.
Hamburg, about 26 ſchil. lubs per crown.
Holland, about 28 ſtivers per crown.

Rule.—Compute either by practice, reduction, or compound multiplication.

EXAMPLES.

1. Red. 7490 livres, 15 ſols to ſterling; exch. at 2s. 6d. per ecu.

By reduction.

$$\begin{array}{r|l} 3 & \underline{7490.75} \\ & 2496.91\dot{6} \\ & \underline{\qquad 2\frac{1}{2}} \\ & 4993^{8}333 \\ & \underline{1248^{4}58\underline{3}} \\ 20 & \underline{6242.291\dot{6}} \\ & 312.11458 = \text{L } 312\ 2\ 3\frac{1}{2} \text{ Anſ.} \end{array}$$

By practice.

$$\begin{array}{r|l} 3 & \underline{7490.75} \\ \text{2s. 6d.} = \frac{1}{8} & \underline{2494.91\dot{6}} \\ & 312.11458 = \text{L } 312\ 2\ 3\frac{1}{2} \end{array}$$

2. Red. 481 liv. to ſterl. exch. $30\frac{1}{2}$d. Anſ. L 20 7 $6\frac{1}{4}$.
3. —— 490 liv. to ſterl. exch. 29d. Anſ. L 19 14 $8\frac{1}{2}$.
4. —— L 172 18 to liv. exch. $31\frac{1}{2}$d. Anſ. 3952 liv.

5. Red. L771 14 to crs. ex. 31¼d. Anſ. 5879.619 crs.
6. —— 304 guin. to liv. exch. 32d. Anſ. 7182 liv.
7. —— 444 liv. to marc-lubs; exch. at 27 ſchil. lubs.
Anſ. 249.75 marc-lubs.
8. —— 533 liv. to guil. exch. 28½ ſtiv. Anſ. 253.175 guil.
9. —— 999 liv. to cur. guil. exch. 27, and agio 4.
Anſ. 467.532 cur. guil.

10. A merchant in Leith imports from France 8412 pinees of yarn, at 15 livres, 19 ſols, 19 deniers per pinee; How much ſterling will pay the account when the exch. is at 32¾d. per ecu? - - - - - - Anſ. L5945 2.

11. Glaſgow ſhips for France 54 hhds. tobacco, weighing nett 81891 lib. at 6½ per lib.; For what ſum will France credit Britain when the exch. is 32¼ per ecu?
Anſ. 16505.162 French crowns.

XII.—*With* SPAIN, *on the Piaſtre; par 3s. 7d. ſterl.*

The Spaniſh money is of two ſorts, viz. *vellon* and *old plate.* A rial vellon is worth 8½ quartas, copper money; and the rial old plate is worth 16 of the ſame quartas, which makes a difference betwixt them in the proportion of 32 to 17, or 53⅛ per cent.

						Value in ſterling.		
4	Marvadies	=	1	Quarta	=	L0	0	0½.5
8½	Quartas	=	1	Rial	=	0	0	5¼.5
8	Rials	=	1	Piaſtre	=	0	3	7
5	Piaſtres	=	1	Piſtole	=	0	17	11
2	Piſtoles	=	1	Doubloon	=	1	15	10

The courſe of exchange between Britain and Spain is generally below par, from 35d. to [illegible]d. per piaſtre; and bills of exchange are always negotiated in plate.

Rule.—When *vellon money* is given, bring it to plate, thus. As 32 : 17 : : vellon : plate. Then to ſterling, by practice.

EXAMPLES.

1. In 49480 rials vellon, How much ſterling; exch. at 42d. per piaſtre?

8
32 : 17 :: 49480 : 26286.25 rials plate.
3s. 4d. = $\frac{1}{6}$ | 3285.78125 piaſtres.
2d. = $\frac{1}{20}$ | 547.630208
27.381510
Anſ. L 575.011718

2. Red. 4488 r. plate to ſterl. exch. 41d. Anſ. L95 16 9.

3. — 5042 piaſt. to ſterl, exch. $40\frac{1}{2}$d. Anſ. L850 16 9.

4. — 988400 quartas to ſterl. exch. 40d.
Anſ. L 2422 10 $11\frac{3}{4}$.

5. — 108 piſtoles to ſterl. exch. $37\frac{1}{2}$d. Anſ. L84 7 6.

6. — L48 7 ſterl. to r. p. exch. 36d. Anſ. 2578,6 r. p.

7. Bought goods in Cadiz to the amount of 8885 rials vellon; How much ſterl. will pay the acct. when the exch. is at 40d. per piaſtre? - - - Anſ. L 98 6 $8\frac{1}{4}$.

8. If I pay a Madrid bill here of L 3000; For how much Spaniſh muſt I draw when the exch. is 42d. per piaſtre? - - - - - - Anſ. 17142.857 piaſtres.

VIII.—With PORTUGAL.

				Value in ſterling.
1000 Rees	=	1 Milree - -	=	L 0 5 $7\frac{1}{2}$
400 Rees	=	1 Cruſade of exch.	=	0 2 3
20 Rees	=	1 Vintin - -	=	0 0 $1\frac{1}{4}\frac{2}{5}$
5 Vintins	=	1 Teſtoon - -	=	0 0 $6\frac{3}{4}$
48 Teſtoons	=	1 Moidore - -	=	1 7 0

Exch. with { *Britain* on the milree; par 5s. $7\frac{1}{2}$d. ſterl.
Holland, about 50 grotes per cruſade.
France, about 400 rees per ecu.

Rule.—Compute either by practice or reduction.

EXAMPLES.

1. In 1640 milrees, How much ſterling; exch. at 5s. 4d. per milree?

By practice.

4s. = $\frac{1}{5}$ | 1640
1s. = $\frac{1}{4}$ | 328
4d. = $\frac{1}{3}$ | 82
| 27 6 8
Anſ. L 437 6 8

By reduction.

1640
64
656
984
12 | 104960
2|0 | 874|6 8
Anſ. L 437 6 8

2. Red. 8000 mil. to ſterl. exch. 5s. 5d.
Anſ. L 2166 13 4.

3. — 4950 mil. to ſterl. exch. at 5s. 6d. Anſ. L 1361 5.

4. — L 400 15 ſterl. to mil. exch. 5s. 6½d.
Anſ. 1446.315 mil.

5. — L 300 ſterl. to cruſ. exch. at par. Anſ. 2666.6 cruſ.

6. — 9900 vintins to ſterl. exch. 5s. 3d. Anſ. L 51 19 6.

7. — 4444 teſtoons to ſterl. exch. 5s. 4¾d.
Anſ. L 119 17 10¾.6

8. — 3400 mil. to Flem. exch. at 51 grotes.
Anſ. L 1806 5 Flem.

9. — 4896 r. to liv. ex. 400 r. per ecu. Anſ. 3672 liv.

10. A factor in Liſbon ſells for his employer in London 7480 yards of broad cloth, at 3 mil. 256 rees per yard; Req. the Liſbon bill of ſales, and ſterling to be remitted home, allowing the factor 2½ per cent. commiſſion when the exch. is at par?

Anſ. { 24354.88 Liſbon bill of ſales.
{ L 6678 11 3½ to be rem. home.

IX.—*With* RUSSIA.

The Ruſſians keep their accounts in rubles and copecks.

				Value in ſterling.
25 Copecks	=	1 Polpolitin	=	L 0 1 2¼
2 Polpolitins	=	1 Politin	=	0 2 3
2 Politins	=	1 Ruble	=	0 4 6
2 Rubles	=	1 Ducat	=	0 9 0

Exch. with {
Britain on the ruble; par 4s. 5d. ſterling.
Holland, about 50 ſtivers per ruble.
Hamburg, about 110 copecks per rixdollar.

Rule.—Compute either by practice or reduction.

EXAMPLES.

1. In 825000 copecks, How much ſterling; exch. at 4s. 6d. per ruble?

By practice.

100)825000

4 = $\frac{1}{5}$ | 8250

6 = $\frac{1}{8}$ | 1650

4 6 | 206 5

Anſ. L 1856 5

By reduction.

8250

$4\frac{1}{2}$

33000

4125

20)37125

Anſ. L 1856 5

2. Red. 1636 rubles to ſterl. exch. 4s. $5\frac{1}{2}$d.

Anſ. L 364 13 10.

3. — L 161 12 $3\frac{1}{2}$ to rub. exch. 4s. $5\frac{1}{2}$d. Anſ. 725 rub.

4. — 725 rub. to ſterl. ex. 4s. $5\frac{1}{2}$d. Anſ. L 161 12 $3\frac{1}{2}$.

5. — 7773 duc. to ſterl. ex. 4s. $6\frac{1}{4}$d. Anſ. L 3449 5 $4\frac{1}{2}$.

6. — 4744 politins to ſterl. ex. 4s. 7d.

7. Edinr. is indebted to Peterſburg in 7766 rubles; For how much ſterling may the Ruſſian merchant draw when the exch. is at 4s. 6d. per ruble? Anſ. L 1747 7.

8. If the annual income of a Ruſſian nobleman be 898800 rubles; How much ſterling has he per week when the exch. is at 4s. $4\frac{3}{4}$d.? Anſ. L 3799 0 $3\frac{1}{4}\frac{11}{13}$.

X.—*With the EAST INDIES.*

			Value in ſterling.
10 Fanams	= 1 Rupee	=	L 0 2 6
100,000 Rupees	= 1 Lack of Rup.	=	1250 0 0
100 Lacks	= 1 Crore	=	125000 0 0
36 Fanams	= 1 Pagoda	=	0 9 0

EXAMPLES.

1. In 48804 fanams, How much ſterling; exch. at 31d. per rupee?

d. 12

48804 × 31 = 1512924

20|126077

Anſ. L 6303 17

2. A gentleman in India has a fortune of 21 lacks of rupees annually; What does it amount to in ſterling when the rupee is valued at 2s. 6d.? Anſ. L 26250.

DRAWING AND REMITTING.

As the courſe of exchange is variable, the drawing or remitting of money may be attended either with loſs or advantage. It is evident, that the leſs value the money of a merchant's own country bears abroad, the more he will gain by *drawing*, and loſe by *remitting*; and the greater its value, the contrary. Therefore, when the exchange is on *ſterling money*, the Britiſh merchant will gain by remitting when the courſe is *high*, and drawing when it is *low*; but when on the *foreign piece*, he will gain by drawing when the courſe is *high*, and remitting when it is *low*.

EXAMPLES.

1. What is gained or loſt by remitting to Amſterdam L 1000 when the exch. is at 34s. 6d., and drawing when it is at 34s.?

a. c. L. L.
As 1.7 : 1.725 :: 1000 : 1014 14 1¼
1000
Anſ. L 14 14 1¼ gained.

2. What is loſt or gained by remitting to France L 500 when the exch. is at 31d. per ecu, and drawing when it is fallen to 30d.?

As 31 : 30 :: 500 : 483 17 5
500
Anſ. L 16 2 7 loſt.

3. When bills on France ſold at 30d. per ecu, Edinr. remitted to Bourdeaux L 8400. When bills had riſen to 30¼d. Edinr. drew for the amount; What advantage attended the negotiation? Anſ. L 140=1⅔ per cent.

4. Remitted L 800 to Spain when the exch. was at 40d. per piaſtre, and drew for the value when at 41d.; What was gained or loſt? - - - Anſ. L 20 gained.

Arbitration is the method of finding ſuch a rate of exchange betwixt any two diſtant places, which ſhall be in proportion to the rates of exchange in the intermediate places through which the circulation is to paſs.

Rule.—Proceed as in proportion, by placing the given odd term on the right, and diſpoſing of each pair of like terms accordingly.

EXAMPLES.

1. When bills on Paris ſell at Amſterdam for $55\frac{1}{5}$ grotes per ecu, and on London at 34s. 6d. Flemiſh per pound ſterling; How ſhould bills on Paris be rated at London to be on par with the other two places?

grotes. grotes. d. d.
414 : $55\frac{1}{5}$ :: 240 : 32 per ecu, Anſ.

2. If bills on Amſterdam ſell at London for 33s. 9d. Flemiſh per pound ſterling, and on Paris at 32d. per ecu; Req. the rate of exchange betwixt Amſterdam and Paris to be at par with the other two?

a. c. grotes. grotes.
As 240 : 32 :: 405 : 54 per ecu, Anſ.

3. A banker in Edinr. remits to Spain L 1000 via Holland, at 35s. per pound ſterling; thence to France at 58 grotes per crown; thence to Venice at 100 crowns per 60 ducats; and thence to Spain at 360 marvadies per ducat: For how many piaſtres of 272 marvadies will the Edinr. banker be credited in Spain?

a. c. a. c. a. c. L.
272 : 360 :: 100 : 60 :: 58 : 35 :: 1000 piaſtres.
Abr. 34 : 45 :: 5 : 3 :: 29 : 210 :: 1000 : 5750.507.

4. A Glaſgow merchant has 7000 guilders due him in Amſterdam, and is offered 22d. ſterling for each guilder; but not being pleaſed with the offer, indorſes a bill for the whole to his factor at Paris, who brought the money to France by exchanging at 55 grotes per ecu, which he remitted his employer at Glaſgow at the rate of 32d. ſterl. per ecu, retaining $\frac{1}{2}$ per cent. com. Which of the ways was moſt advantageous to the Glaſgow merchant?

a. c. a. c. guild.
240 : 32 :: 55 : 40 :: 7000 : L 678 15 9

Deduct factor's commiſſion	3	7	$10\frac{1}{4}$
Per cirulation - - - -	675	7	$10\frac{3}{4}$
Per the offer - - - - -	641	13	4
Gained by circulation - -	L 33	14	$6\frac{3}{4}$

Thus, a perſon thoroughly acquainted with this rule may trace out a path for circulating his money to great advantage; and thus, his ſkill in arbitration may be to him a ſource of wealth.

INVOLUTION, OR RAISING OF POWERS.

INVOLUTION is the multiplying of a number into itſelf any number of times required. The number itſelf is called the root, or firſt power. If it be multiplied once into itſelf, the product is called the ſquare, or ſecond power; if twice, the cube, or third power; if thrice, the biquadrate, or fourth power; and if four times, the ſurſolid, or fifth power.

TABLE OF POWERS.

Roots	1	2	3	4	5	6	7	8	9
Squares	1	4	9	16	25	36	49	64	81
Cubes	1	8	27	64	125	216	343	512	729
Biquadrates	1	16	81	256	625	1296	2401	4096	6561

EVOLUTION, OR EXTRACTION OF ROOTS.

PROB. I.—To extract the SQUARE ROOT.

RULE I.—Divide the given number into periods of two figures each, beginning at the place of units.

II.—Find the greateſt ſquare in the left hand period, which place underneath, and its root in the quotient; ſubtract the ſquare from the period, and to the remainder annex the following period for a dividend.

III.—Double the root for a diviſor, and find how often it is contained in the dividend, excluding the place of units; ſet the reſult both in the quotient or root and units place of the diviſor.

IV.—Multiply the diviſor thus increaſed by the laſt figure in the root; ſubtract the product as before; annex another period; and ſo on to the laſt.

Note. If there are decimals in the given number, they muſt be pointed off into periods towards the right.

EXAMPLES.

1. Req. the ſquare root of 54756?

```
 54756(234 Anſ.
 4
43)147
   129
464)1856
    1856
```

(2.) Req the ſq. root of 1190.25?

```
 1190.25(34.5 Anſ.
 9
64)290
   256
685)3425
    3425
```

Proof. The ſquare of the root with the remainder added (if any), will exactly equal the given number.

3. Req. the ſquare root of 1347.875? Anſ. 36.713
4. ———————— 460905.21? Anſ. 678.9
5. ———————— 1719432.9? Anſ.

PRACTICAL QUESTIONS.

1. A gentleman has a garden of an irregular form, that meaſures 119716 ſquare links, which he wiſhes to exchange for a ſquare one of equal content; Req. the ſide of the ſquare? - - - - - - Anſ. 346 links.

2. The diameter of a cooler is 4 feet; Req. the diameter of another that will contain 3 times the quantity? Anſ. 6.92 feet.

3. What length of a rope tied to a cow's tail will allow her to graze juſt one half of a Scots acre, ſuppoſing the length of the cow and tail together to be 9 feet? Anſ. 27.27 yards.

4. In a ſquare plantation containing 3182656 trees; Req. the length of its ſide when there are 21 feet betwixt each row? - - - - - - Anſ. 12481 yards.

5. Suppoſe the length of a horſe's tether to be 27 feet, which allows him to eat 2290.2264 ſquare yards; How

many additional yards will he have liberty to eat, by lengthening his tether 9 feet? - Anſ. 537.2136 yards.

6. If the area of a circle be .7854; Req. the ſide of a ſquare that contains 4 times the area? - Anſ. 1.77

7. Right ſouth of the manſe, at the diſtance of 7 furlongs, ſtands the kirk; and 2 miles due eaſt of the ſame, ſtands the mill; Req. the diſtance betwixt the kirk and the mill? - - - - - - - - - - Anſ. 2.183 miles.

8. In a gentleman's pleaſure ground there are two circular walks, the diameter of the one is 80 yards; and the other contains 10 times the area; Req. its diameter? Anſ. 252.98 yards.

9. Two men ſet off from the ſame place; the one travels eaſt 20 miles per day, and the other ſouth 26; How far are they diſtant on the evening of the 7th day? Anſ. 229.61 miles.

10. A rope 400 yards long ſuſpended from the top of a wall 900 feet high, reaches the oppoſite bank of a river running by the foot of the wall; Req. the breadth of the river? - - - - - - - - - Anſ. 793.7 feet.

11. The diameter of a malt-kiln is 13 feet, and is too little by $\frac{4}{7}$; Req. the diameter of one that will anſwer the purpoſe? - - - - - - - - - - Anſ. 17.4 feet.

12. A ſurveyor meaſuring a marſh found that it lay exactly in the ſhape of a right angled triangle; that the baſe meaſured 905 links, and the perpendicular 840; but the hypothenuſe being inacceſſible, could not be meaſured with the chain, reſolves to find it by the ſquare root; Req. its length? - - - - - - Anſ. 1234.75 links.

13. A ſun-dial is placed in a ſtraight line betwixt an obeliſk and a ſteeple, and is juſt 148 feet from the top of each; the ſteeple is 124 feet high, and the obeliſk 84; they ſtand on the oppoſite banks of a fiſh-pond; Req. its breadth? - - - - - - - Anſ. 202.64 feet.

14. Suppoſe a ſpectator on the top of an eminence 12 feet high, (including the height of the eye), and the ſenſible horizon free of all obſtruction to the ſight; It is required to find how far he will ſee by looking around him on the ſurface of the globe?

Solution.—The diameter of the earth is found by experiments to be 7970 miles; conſequently, its ſemidiameter is 21040600 feet.

Now, to the $\frac{1}{2}$ diameter of the earth 21040600
Add the height of the ſpectator - - 12
Makes - - - - - - - - - - 21040612
The ſq. of which is 442707353334544
Subtract ſq. $\frac{1}{2}$ diam. 442706848360000
Leaves - - - - - - - 504974544$\sqrt{}$22471 feet.
Anſ.=4 miles, 2 fur, 1 pole.

15. What is the difference betwixt 3 feet ſquare, and 3 ſquare feet? - - - 3×3=9−3=6 feet, Anſ.

Prob. II.—To extract the Cube Root.

Rule I.—Divide the given numbers into periods of three figures each, beginning at the place of units.

II.—Find the greateſt cube in the left hand period; place its root in the quotient; ſubtract the cube itſelf from the ſaid period, and to the remainder annex the following period, which call the *reſolvend.*

III.—Multiply the ſquare of that part of the root found by 300 for a trial diviſor; by which divide the *reſolvend*, and put the quotient figure for the ſecond place in the root.

IV.—Multiply the former part of the root by the laſt figure placed in it, and this product again by 30, which place under the trial diviſor; and, laſtly, under the ſame write the ſquare of the figure laſt placed in the root, which will complete the diviſor.

V.—Multiply the ſum of theſe three by the figure laſt placed in the root, and ſubtract the product from the *reſolvend;* to the remainder annex the next period for a new *reſolvend*, with which proceed as before.

Note. When there are decimals in the given number, each period muſt conſiſt of three decimal places; and if the given decimal does not contain ſo many places, the deficiency muſt be ſupplied by annexing cyphers.

EXAMPLES.

1. Req. the cube root of 12812904?

```
    12812904(234 Anſ.
      8
 1200)4812
   180
     9
 1389 4167
158700)645904
  2760
    16
161[illegible]76)645904
   4
```

Proof. The cube of the root with the remainder added (if any), will exactly equal the given number.

2. Req. the cube root of 12261527232? Anſ. 4968.
3. ——————— 1848537525?
4. ——————— 84.75?
5. ——————— .97345?
6. ——————— 1.9995?

PRACTICAL QUESTIONS.

1. An earthen mound is 340 feet long, 280 broad, and 240 deep; Req. the length of the ſide of a cube equal to it in magnitude? - - Anſ. 283.69 feet.

2. A diſtiller has a granary whoſe length is 17 feet, breadth 10, and depth 8, which holds 170 bolls; Req. the dimenſions of a ſimilar one that will hold 1360 bolls?

Anſ. Length 34, breadth 20, and depth 16 feet.

3. Req. the weight of a bullet of braſs whoſe diameter is 4 inches, when one of 8 inches diameter of the ſame metal weighs 72 lib.?

Solution.—*Like ſolids are in proportion as the cubes of their diameters.* Therefore, as 512 : 64 : : 72 lib. : 9 lib. the anſwer.

4. If a globe whoſe diameter is 8 inches weigh 20 lib. Req. the diameter of another globe of the ſame metal whoſe weight is 300 lib. - - - Anſ. 19.7 inches.

5. If the ſolid content of [illegible] be 175616, What is the ſide of a cube of equal ſolidity? - - Anſ. 56.

6. Req. the ſide of a cubical granary that holds 500 bolls of wheat? - - - - - Anſ. 13 feet, 7 inches.

7. There is a ſtone of a cubical form that contains 35937 ſolid feet; Req. the ſuperficial content of one of its ſides? - - - - - - - - Anſ. 1089 ſq. feet.

8. Req. the length of the ſide of a cubical cheſt that will hold 8500 oranges, each $2\frac{1}{2}$ inches diameter?

Anſ. 51.02 inches.

9. What is the difference betwixt half a foot ſolid, and half a ſolid foot?

$12\times12\times12=\frac{1728}{2}=864$ half a ſolid foot.

$6\times\ 6\times\ 6\ -\ =216$ half a foot ſolid.

Anſ. 648 cubic inches.

DUODECIMALS.

Rule I.—Under the multiplicand write the correſponding denominations of the multiplier.

II.—Multiply each term in the multiplicand, beginning at the loweſt, by the feet in the multiplier; write each reſult under its reſpective term, and carry at 12.

III.—In the ſame manner multiply by the inches or primes in the multiplier, and write the reſult of each term one place more to the right.

IV.—Proceed in the ſame manner with the ſeconds, thirds, &c. always ſetting the reſults one place more to the right; and, in adding the ſeveral products, carry at 12, and the ſum will be the anſwer.

EXAMPLES.

1. Mul. 9 feet 4 inches, by 4 feet 4 inches.

	9	4	
	4	4	
	37	4	
	3	1	4
Anſ.	40	5	4

	feet.	′	″		
(2.) Mul.	22	3	8		
By	8	5	2		
	178	5	4		
	9	3	6	4	
		3	8	7	4
Anſ.	188	0	6	14	4

3. Mul. 9 feet 7 inch. by 3 feet 6 inch. Anſ. 33 f. 6′ 6″.
4. — 12 feet 6 inch. by 4 feet 6 inch. Anſ. 56f 3′ 0″.
5. — 28 feet 3 inch. by 3 feet 6 inch. Anſ.
6. — 125 feet 5 inch. by 3 feet 3 inch. Anſ.

Note.—When the number of feet is large, multiply all the denominations in the multiplicand by the feet in the multiplier; and take aliquot parts for the inches, ſeconds, &c.

EXAMPLES.

1. Mult.	134	2	9		
By	11	6			feet. ′ ″
	1476	6	3		=134 2 9×11
	67	1	4	6	$=\frac{1}{2}$ of do.
Anſ.	1543	7	7	6	=total product.

TABLE OF ALIQUOT PARTS.

1 Inch $=\frac{1}{12}$ of a foot.
2 Do. $=\frac{1}{6}$ of do.
3 Do. $=\frac{1}{4}$ of do.
4 Do. $=\frac{1}{3}$ of do.
5 Do. $=\frac{1}{3}$ & $\frac{1}{12}$ of do.
6 Do. $=\frac{1}{2}$ of do.
7 Inches $=\frac{1}{2}$ & $\frac{1}{12}$ of a foot.
8 Do. $=\frac{1}{2}$ & $\frac{1}{6}$ of do.
9 Do. $=\frac{1}{2}$ & $\frac{1}{4}$ of do.
10 Do. $=\frac{1}{2}$ & $\frac{1}{3}$ of do.
11 Do. $=\frac{1}{2}$, $\frac{1}{3}$, & $\frac{1}{12}$ of do.

2. Mul. 774 feet 4 inch. and 10 parts, by 9 feet 9 inch.
Anſ. 7550 f. 5′ 1″ 6‴.
3. — 404 f. 5 in. and 9 parts, by 12 f. 10 in. Anſ.
4. — 554 f. 6 in. and 11 parts, by 42 f. 8 in. Anſ.

APPLICATION TO BUSINESS.

1. There is a board 14 feet 3 inches in length, 2 feet 3 inch. and 4 ſec. in breadth; How many ſquare feet does it contain? - - - - - - Anſ. 32 f. 5′ 6″.

2. How many ſolid feet are contained in a log of mahogany whoſe length is 21 feet 4 inches, breadth 3 feet 5 inch., and thickneſs 2 feet 7 inch.? Anſ. 188 f. 3′ 6″ 8‴.

3. How many ſquare feet are contained in a floor that meaſures 33 feet 8 inch. by 22 feet 9 inch.; and what

will the carpenter's account come to, at L 3 15 per ſquare of 100 feet? - - - - Anſ. 765 f. 11′.—L 28 14 7½.

4. Suppoſe a bale of goods to be 4 feet 9 inch. long, 3 feet 9 inch. broad, and 4 feet 6 inch. thick; Req. its tonnage and freight, at L 3 per ton?

Anſ. 2 t. 0 f. 0′ 6″ tonnage.—L 6 0 2½ freight.

5. A houſe of 3 ſtories contains 7 windows in each ſtory. The height of the windows in the firſt and ſecond ſtories is 6 feet 10 inches; thoſe in the third, 5 feet 4 inches; the breadth throughout is 3 feet 10 inches and 6 parts; What will the expence of glazing come to, at 1s. 2d. per foot. - - - - - - - - Anſ. L 30 1 3.

6. There is a window that contains 32 panes of glaſs, each meaſuring 14 inch. 9 parts, by 10 inch. 9 parts; How many ſquare feet of glazing does it contain, and what will be the expence, at 1s. 3d. per ſquare foot?

Area 35 f. 2′ 10″.—Expence L 2 4 0¼ Anſ.

7. If a wall be 45 feet 6 inches long, 12 feet 4 inches high, and 2 feet 3 inches thick; How many ſolid feet does it contain? - - - - - - Anſ. 1262 f. 7′ 6″.

8. Req. the content and value of a ſlab of marble whoſe length is 6 feet 3 inches, and breadth 3 feet 9 inches, at 7s. 6d. per ſquare foot?

Content 23 f. 9′.—Value L 8 18 1½ Anſ.

PROMISCUOUS QUESTIONS.

1. A merchant has in caſh L 114; in accounts L419; in bills L 715; a houſe worth L 841; a ſhip valued at L 600; a ſmall eſtate to the value of L 940; goods on hand to the amount of L 777; What does the whole amount to? - - - - - - - - - - Anſ. L 4406.

2. An old man's age being aſked, anſwered, I have 18 children, the eldeſt of which was born when I was 27 years old, and on an average there were 2 years betwixt the births of each of them, and now the youngeſt is 32 years; Req. the old man's age? Anſ. 93 years.

3. What number multiplied by 7 and divided by 9, will quote 144? - - - - - - - - - - Anſ. 185⅐.

4. If the inhabitants of a village conſume 4 bolls of wheat in a day, What quantity at that rate will ſerve them a year? - - - - - - - - - Anſ. 1460 bolls.

5. How many barleycorns, each placed end to end, will reach round the terreſtrial globe, it being divided into 360 degrees, each degree containing 69½ miles? Anſ. 4755801600 barleycorns.

6. If 1 copper penny-piece weigh 12 drams Avoird. What will be the weight of L 5 ſterl. of the ſame metal? Anſ. 56 lib. 4 oz.

7. How many yards of cloth will be ſufficient to clothe 3420 men, when each takes 5 yds. 3 qrs. 3 nails? Anſ. 20306 yds. 1 qr.

8. How often will a wheel of 23 feet 4 inches circumference turn round its axis in running the diſtance of 144 miles, 3 furlings, and 14 poles? Anſ. $32679\frac{9}{10}$ times.

9. Bought two pieces of cloth, each containing 48 yards, which coſt in all L 25 12. The firſt piece coſt 4s. per yard; Req. the price per yard of the ſecond? Anſ. 6s. 8d.

10. If a labourer receives 1s. 2d. for every working day for the firſt 10 months, and only 10d. per day for the remaining 2 months; What does his wages amount to per year? - - - - - - - - - Anſ. L 17 7 10.

11. A builder has 22 maſons at 1s. 8d. per day; 12 barrowmen at 1s. 2d.; 8 miners at 1s. 10d.; 9 carters at 1s. 1d.; and 2 wrights at 1s. 7d. per day; What ſum does he pay them weekly? - - - Anſ. L 23 9 6.

12. A ſnail in getting up a tall tree was obſerved to climb 16 inches per day, but every night came down 7; In how many days by this method would he reach to the height of 80 feet 1 inch? - - - - Anſ. 106 days.

13. If 44 yards of broad cloth are worth 176 yards of linen, and 12 yards of linen worth L 2; How many yards of broad cloth, at the ſame rate, are worth 840 yards of linen, at 3s. 9½d. per yard? Anſ. 238 yds. 3 qrs. 2 n.

14. If the high-way betwixt Cupar and Kinghorn be 22 miles long, and 30 feet broad; How many Scots acres